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PSYCHOLOGICAL STUDIES

BY

HARLOW GALE.

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NUMBER ONE.

JULY, 1900.

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PREFACE.

These studies are offered to my friends and those interested in these subjects, more as the fruits of my personal study and interests than as a claim for professional recognition or for their ordinary collegiate availability. For the rather wide range covered by the various studies indicates my dissatisfaction at the often arbitrary limits put upon psychological inquiry by many professional psychologists and by the spirit still of most of our Universities. Thus not only my own incomparable satisfaction at finally getting to some first-hand knowledge of our brain as the wonderful basis of our mental life, but the yearly experience with college Juniors shuddering or running for their salts bottles on first seeing a piece of the beautiful substance which has been the most intimate and indispensable part of their existence, such experiences have deepened my interest in the importance of a knowledge of the brain for all who make any pretence to any modern education and culture. Too often our books on physiological Psychology have not fulfilled their title except in abstract terms, or have had the assuaging function of comforting their timid readers that there was after all no harm to be apprehended for the entity "Mind" in its disdainful and temporary conjunction with the gross, material brain, and that the only good from this new-fashioned Brain-psychology was the disciplinary difficulties of its Latin topography. Until not merely professional scientists, but unprofessional educated people, come to see and know something of the real brain and have their admiration aroused at its wonderful mechanism is it scarcely to be hoped that they can outgrow the popular ignorant horror at any dependence of mind on brain.

Similarly an inclination to watch very live and real psychology when often weary with the dead or artificial book psychology leads me to the queries respecting people's commercial actions as influenced by street car and magazine advertising, to the growth of our children's bodily and mental stature thro language, and to our sense illusions at the dinner table.

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The puzzles of human nature*, too, which appear nearer home than we often suspect, are a fascinating recreation to follow up and try to unravel by associating their distorted or unusually combined human elements with those in the average mental complex.

Thus a chance copy of the Proceedings of the Society for Psychical Research aroused a real interest during my Sophomore year in college, when we had no intellectual interests except shielding ourselves from the disciplinary pricks, and this interest outside of the curricula has ever since grown deeper and more justified. The patient and thorough work of this Society has done a vast deal to dissipate many modern forms of superstition (instead of fostering them, as some Psychologists affirm apriori), in connecting our conscious mental life with all degrees of sub-conscious or unconscious nervous action, in making us more observant of real human nature and making us more charitable of the misinterpretations or even of some deception in these less common mental phenomena.

As against the range of interests shown in these studies is the danger of the dissipation of one's energies. Specialization is already a necessity for every worker in our young and composite science, and most important specialties are being splendidly followed up at Leipzig, Berlin, Heidelberg, Würzburg, Turin, Madrid, Paris, Worcester, Ithaca, and elsewhere. But thro these studies even runs an interest which has focused especially in five subsequent experimental studies in reasoning. And, as in the plan of a personal education, the value of these reasoning studies is to clear the way for one's higher conduct and living, whereby the final aim of the greatest amount of the best happiness is gained, so we have made several experimental studies in pleasure-pain. It is hoped that this material can soon follow this initial number in two subsequent numbers of studies in reasoning and in pleasure-pain. It was an original interest in these subjects which, after several years' vain labor for any satisfaction within the religious or the usual philosophical limits of Logic and Ethics, led me to find their real ground and solutions in psychological study.

I therefore wish to take this opportunity of acknowledging my very great indebtedness and gratitude to the different

*Besides the article herein contained on "A Case of Alleged Loss of Personal Identity", see "A Study in Spiritistic Hallucinations" in the Proceedings of the Society for Psychical Research, part 35, Feb. 1900; Vol. 15, pp. 65-89.

teachers from whom I have gained stimulus and strength during nine graduate years of a self-planned course of study. In chronological order those acknowledgments are heartily given to Professors F. B. Tarbell and W. G. Sumner for the preliminary and only undergraduate awakening at Yale and the latter's graduate introduction into folk-psychology; to Professor Sidgwick of Cambridge, Eng., for a year's contact with his keen analysis of the human heart and his Nestorship of the Society for Psychical Research; to Professor W. Wundt of Leipzig, and his then assistants, Drs. O. Külpe, E. Meumann and F. Kiesow, for the inestimable profit from a three and a half year's connection with his Institute for Experimental Psychology; to Professor Ebbinghaus, then of Berlin, for one semester's glimpse of his vigor and freshness; to Professor Paul Flechsig, and his then assistant, Dr. H. Teuscher, for a year's attendance at his two clinics for nervous diseases and his lectures on brain-anatomy; to Professors W. His, W. Spateholtz, and Dr. H. Held for a summer and winter's freedom of their Anatomical Institute in Leipzig and for the special preparation and study there of brain matter.

Harlow Gale.

Minneapolis, July, 1900.

OUR NERVOUS SYSTEM AND ITS USE.

The greatest lesson of the last half-century is that not merely the plants, amoeba, frogs and monkeys, but each of us also, our very own selves, are organisms formed by the complicated action of the many forces making up our environment. Mechanical contact, heat, cold, some gases and chemical food stuffs, varying degrees of light and darkness, a limited range of color vibrations and of sound vibrations,—all are stimulating us to action. According as these actions conduce on the whole not merely to the immediate welfare of the organism, but more and more indirectly to its future welfare, are there better chances for the organism's survival and propagation. The interpolation of consciousness between the stimulus and the reaction as a knowledge of our own organism and its environment, and as a pleasure-pain valuation of the kinds and degrees of the stimuli,—this interpolation of these two mental factors of knowledge and feeling only adds more prevision to our reactions and thus simply separates us in degree from our other closely related organisms. From this evolution point of view then, our developed nervous system is a means of getting more and more specialized and delicate stimuli from our surrounding world, and of making finer and more useful reactions. Between the reception of the stimulus and its motor expression are all degrees of directness and of remoteness, as indicated in the somewhat arbitrary divisions of actions

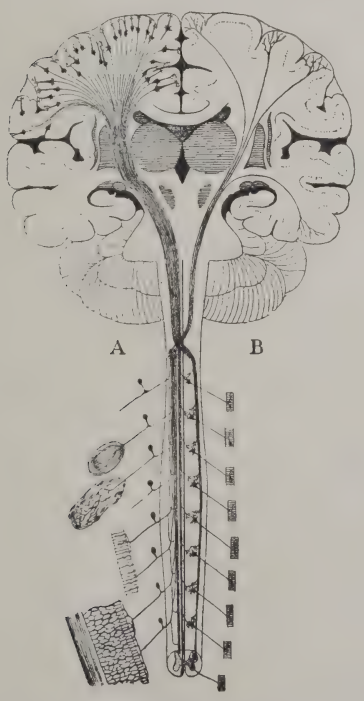


FIG. 1.
Schematic plan of the intaking (sensory) nervous system and the outgoing (motor) system.
From Van Gehuchten: Le systeme nerveux de l'homme. 1893. Fig. 417.

as reflex, instinctive, impulsive, expressive, habitual, voluntary, ideational, etc. All these kinds of action only differ in the immediateness or indirectness of the connection made between the stimulus and the reaction.

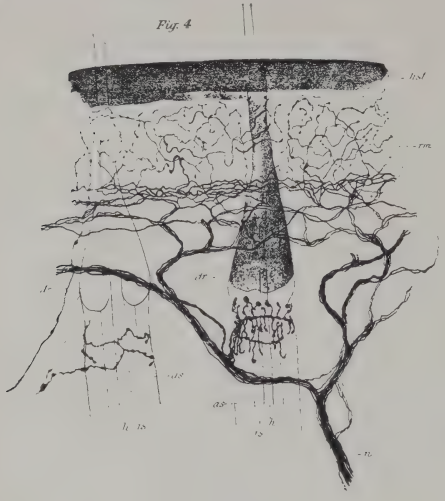


FIG. 2.

Section thro skin, showing free nerve endings in the skin and the special nerve-endings about the base of hairs.

From Retzius: Biologische Untersuchungen. 1892. Bd. IV, Taf. XV, Fig 4.

When we thus consider our nervous system as the apparatus for our reaction to the world about us, and as thus consisting of the three parts of ingress, association and exit (motion), this is shown as a schematic plan in Fig. 1. The ingress appartus (sensory system) is indicated on the right of the spinal cord below, where are shown the free, branch-like endings of the nerves and a couple of touch buds in the skin for taking in the sensations of touch, heat, cold, or pain. These stimuli are conducted by fibers up the spinal cord, cross over at the top enlargement of the cord (medulla oblongata) and passing up into the brain end in free branch-like endings in the grey surface of the large brain (seen in the right half of the large brain in the figure). The outgoing motor system is represented by a few cells in the surface of the (left) hemisphere of the large brain, from which cells the outgoing fibres come down thro the brain, cross over to the opposite side of the spinal cord, and, acting upon the immediate motor cells of the cord, the impulse goes out to the muscles (row on the right, outside). The intervening system for associating the sensory endings with the motor cells is not shown in the plan; but with this scheme for an outline to be kept in mind we can proceed to fill out the details.

INGRESS (SENSORY) SYSTEM.

Our real "feelers" for stimuli from the skin are shown in Fig. 1, in their two general forms of (1) some kind of pad or

corpuscle (on the left, above), in or around which the nerve endings lie; or (2) of free branch-like endings (left, below). Fig. 2 also shows the branch-like endings of the nerves somewhat as they would look when separated out from the inner layers of the skin, just under the outer hard layer. These many fine endings unite into larger and larger bundles as they run down below, and as bundles of insulated nerves like a cable they go thro the muscles into the spinal cord. To give one

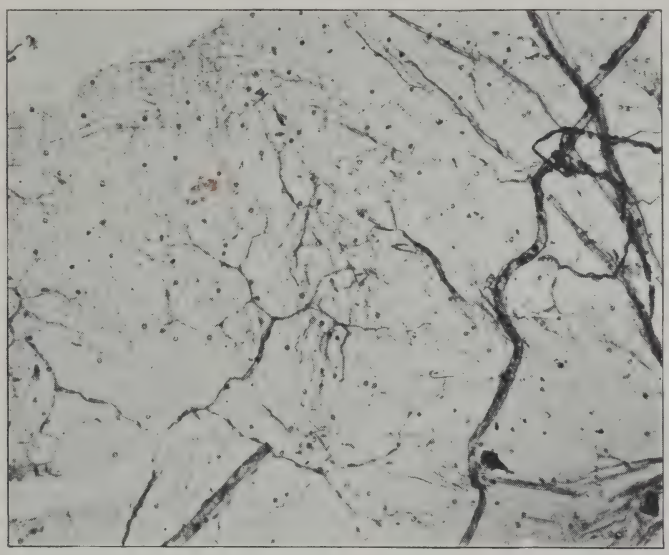


FIG. 3.
Free nerve-endings in skin. (Torpedo). Micro-photograph. Magnified 75 diameters.

an idea of the mass of fibres concerned with this sense of touch alone, Prof. von Frey has lately estimated that the number of these touch nerve endings on the surface of the body, exclusive of the head, is about half a million.* Here is also seen the specially sensitive apparatus for taking in touch thro the mechanical leverage of hairs. For around the base of the hair (on the right) within the skin, the nerve forms a circle, and from this circle go off about twenty little branches, clustering about the sac at the hair's root, so that apparently when the hair is moved from the outside in any direction, the base of the hair presses against some of these little surrounding branches. This wonderful apparatus accounts for the aston-

*Sitzungs-Berichte der Physikalisch-medicinischen Gesellschaft zu Würzburg, Nov. 1899. M. von Frey: Ueber den Ortsinn der Haut.

ishing delicacy of the sense of touch thro the hairs of the body. More nearly how the free touch endings look is shown in the micro-photograph, Fig. 3, where the smaller branch-like endings are the nerves (the larger lines being blood vessels). Similar nerve endings are found in the teeth, as shown in Fig. 4. These only take in pain, however, for tho we seem to be able to distinguish heat from cold thro the teeth, we find that when our teeth or their fillings are touched with a hot or cold rod, we can only perceive different degrees of pain.

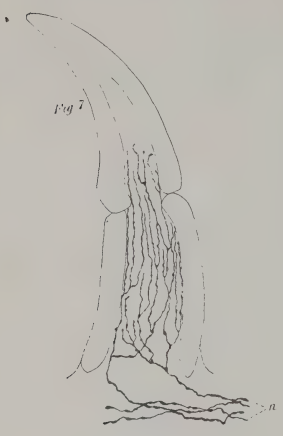


FIG. 4.
Nerve endings for pain in teeth.
From Retzius: Ibid. Taf. XVII. Fig. 7.

Coming to the pathways of the higher kinds of knowledge of hearing and sight one finds the sense apparatus still on the same plan. For tho the air waves are changed to membrane vibrations, conducted thro a series of levers in the three ear bones to another membrane, and thence thro fluid waves to different parts of the basilar membrane, the stimulus is finally transferred again to fine nerve endings lying on this basilar membrane. The stimuli thus taken up finally under the arched bows (Organs of Corti) in Fig. 5, are carried by the nerve fibres running thence (to the left) within the bony shelf of the cochlea,

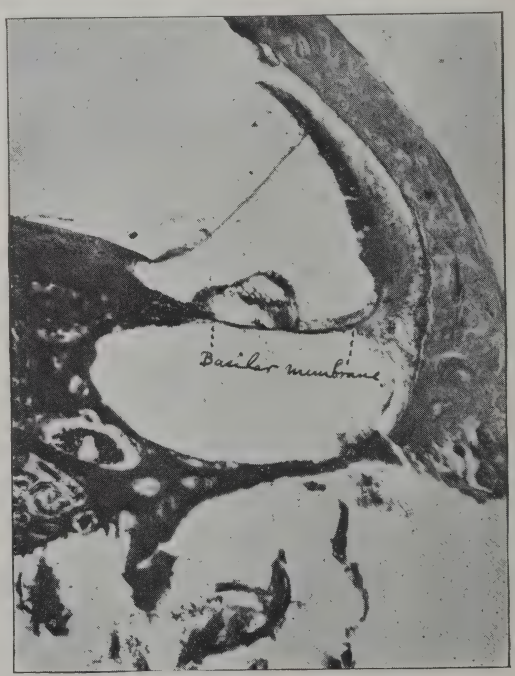


FIG. 5. Section thro cochlea. (Young rat). X 75.

turning downward thro the bipolar cells of the nerves in the axis of the cochlea, and running into the medulla as the eighth cranial nerve, thus the stimuli are ultimately brought to the cortex in the temporal region of the brain. Also in our greatest knowledge sense,—that of sight,—the final stimulus acts on the nerve endings (rods and cones) in the back layer of the retina, Fig. 6, whence the stimulus is conducted with two interruptions thro the three layers of cells which are shown clearly in the schematic plan in Fig 11. In Fig. 6 is seen the mass of

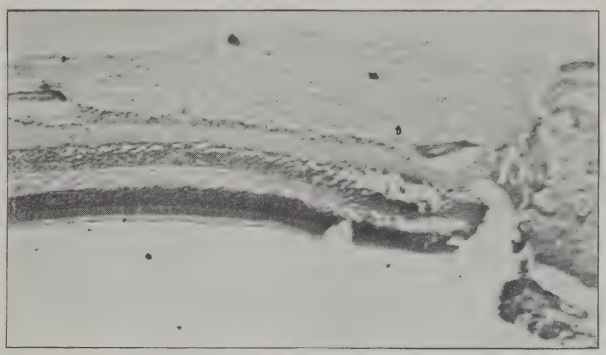


Fig. 6.
Section thro retina (human). X 75.

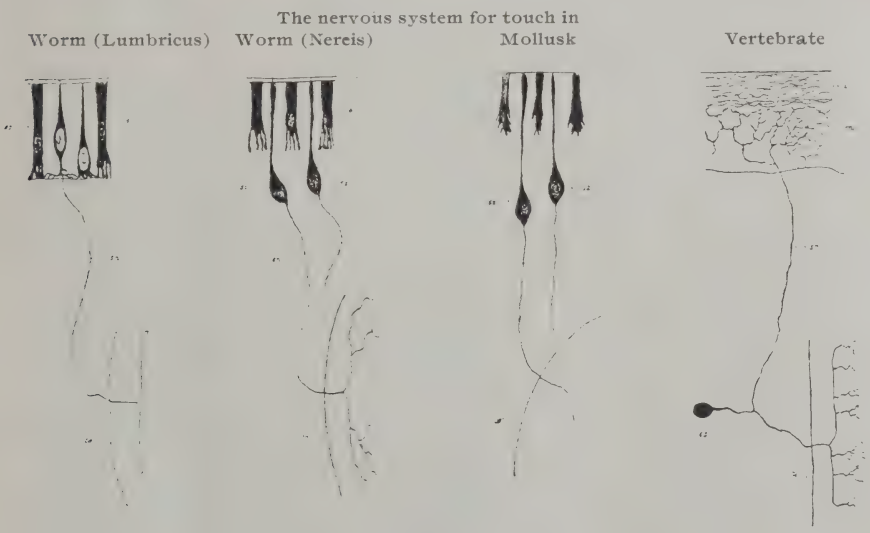


Fig. 7.
From Retzius: Ibid. S. 56.

fibres above, which are carrying the sight stimulus to the right and out thro the egress from the eyeball (blind spot) on the extreme right, forming the bundle of fibres making up the

optic nerve (second cranial nerve). The stimuli thus ultimately reach the posterior part of the brain.

The nervous apparatus of the different senses for taking in the original sensation elements of our knowledge are thus very simple in their uniform plan, however complicated and various the fine anatomy of the sense organs and nerves may appear to be or really be. For the uniform plan of the sensory nerves is where a nerve cell somewhere outside the spinal cord and brain, develops two arms or processes, one of which grows out toward the surface of the body to the special sense organ in the skin, tongue, nose, ear, and eye, thus to receive and conduct inward the stimulus. The second arm of the cell grows inward and enters the spinal cord or the brain direct (in the case of smell), thus conducting the stimulus received thro the first arm and the body of the cell up the cord and thro the brain to the end-stations of the senses in the gray surface (cortex) of the large brain. In Fig. 7, the eminent Swedish biologist, Retzius, has shown that in the sense of touch this bipolar cell has receded from near the surface of the body in the lower animals, to a securer position in the vertebrates as the bunches of cells which make up the rows of the spinal ganglia on either side of the spinal cord. This origin of the sensory system was only demonstrated by Professor His, of

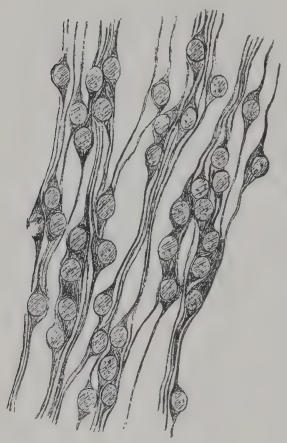


FIG. 8. (x about 250.)
Groups of cells and fibers from a ganglion of a human embryo.
From His: Zur Geschichte des menschlichen Rueckenmarkes und der Nervenwurzeln. 1886.

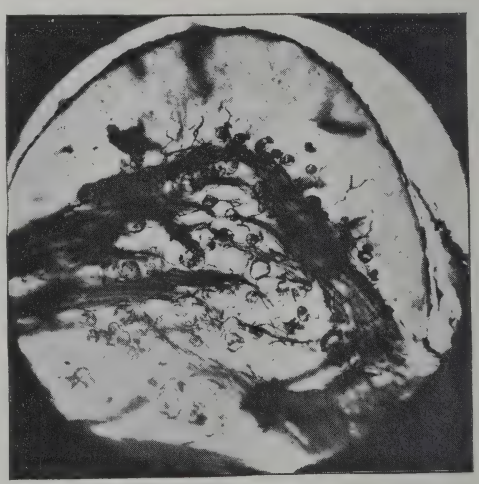


FIG. 9. (x 38).
Section through a spinal ganglion. (Cat).

Leipzig, so late as 1886. (See Fig. 8). In Fig. 9 is shown a photograph of a few of the mass of the sensory bipolar cells making up a whole spinal ganglion, and traversing it are the touch fibers coming from the surface of the body and going into the spinal cord. And in Fig. 10 is seen on the right the dark oval mass of a ganglion with fibres coming from the surface of the body below, and on the left the companion ganglion with its other arm going into the cross section of the cord. (Unfortunately the section does not show both arms to the same ganglion.)

FIG. 10. Magnified nine times.
Horizontal section thro body of fœtus (pig), showing spinal ganglia and cord.

Tho the other senses are outwardly so very different from touch in their apparatus, yet Retzius has shown in Fig. 11 that all the senses are evidently only at various stages of the development which the original sense of touch has gone thro, as in Fig. 7. This evident differentiation of an original primitive sense (probably more nearly like our present touch) into the specialized senses of taste, smell, hearing, and sight, together with the probable additional senses of heat, cold, and pain, this had been known for some time. But the late progress in the embryological anatomy of the senses, has been to give us this simplified uniform plan. Thus in smell, the real sensory nerve cells are still very near the surface in the membrane lining of the nose, thus having a very short outward arm, and an inward arm which soon gives over the stimulus to the arms of a larger interpolated cell. In sight likewise, the sensory cells proper are the exterior ones which end in the rods and cones, the ingoing arms being peculiarly interrupted twice as the stimulus is taken in thro

two other sets of cells still in the retina before it is carried along the optic nerve. With hearing, the sensory cells are situated in the axis of the cochlea; in taste they have receded far-

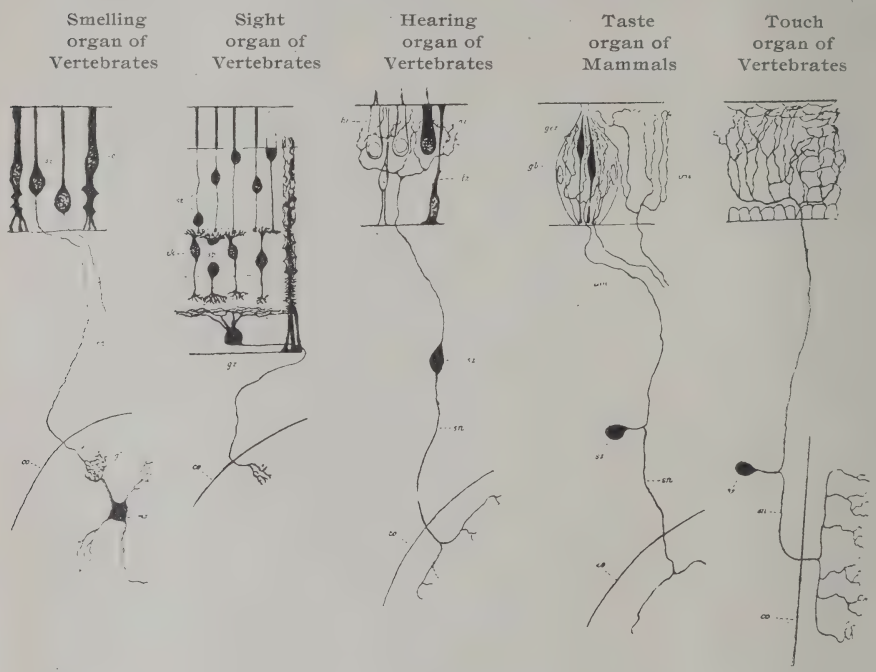

Smelling organ of Vertebrates
Sight organ of Vertebrates
Hearing organ of Vertebrates
Taste organ of Mammals
Touch organ of Vertebrates

FIG. 11.
The sensory nervous system and the sense organs.
From Retzius: Ibid. S. 56.

ther from the surface (ganglia Gasseri and Petrosum); while with touch they are farthest from the surface in the spinal ganglia. Even in the sensory part of the intricate cranial nerves the same plan evidently exists; and the sensations of touch from the face, head, interior of the mouth and throat, and the special pain sensations from the heart, stomach, lungs and viscera, are taken in by the Facial, Trigeminal, Glossopharangeal, and Vagus nerves, thro their cells in their respective ganglia scattered about in the head, but outside the brain.

As these newer discoveries have scarcely gotten into the psychological books, it can hardly be emphasized too much that the sensory apparatus for taking in our knowledge of the world about us is built upon the plan of these bipolar cells in groups (ganglia) at various distances between the sense organs on the surface of the body and the central conduction masses of the spinal cord and brain (cerebro-spinal system). Thus the

strictly sensory cells are not in the spinal cord or brain, as is popularly supposed. The indispensable function of these sensory cells is to put us in contact with our environment. For if we did not have them and so got no touches, tastes, smells, sounds, and sights, we would be imbeciles and idiots, no matter how perfect was our cerebro-spinal system. Such a case as Laura Bridgman's shows us how much one avenue of contact thro touch alone can do for one's reaction, and also how much more completely the higher knowledge avenues of hearing and sight fit us for reactions to our welfare.

Another popular idea which must be revised is the old one that the stimuli from the senses are taken in by long, continuous fibers to their final station in the brain. For one of the chief lessons of modern nerve histology, and in particular of the famous Spanish discoverer, S. Ramon y Cajal, is that the nerve conduction is not continuous, but may have several interruptions. Even within the organs of smell and sight, there were one or two such interruptions, by which the stimulus from light, e. g., was passed on from the arms of the cells in connection with the rods and cones by touching an intaking arm of the next cell, the outgoing arm of this second cell comes in contact with the intaking arm of a third cell, from which a comparatively long fibre conducts the stimulus as a part of the optic nerve into the brain. But in the other senses the stimulus is carried continuously thro the bipolar cell with its two arms, at least into the spinal

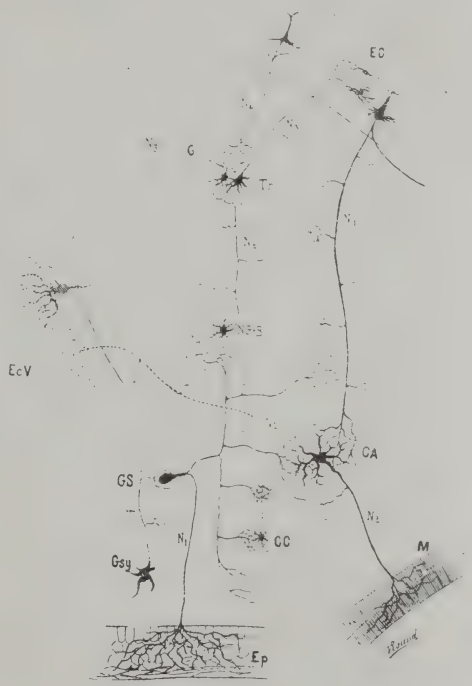


FIG. 12.

Plan of interrupted nerve propagation. From Dejerine: Anatomie des centres nerveux. Fig. 113. 1895.

cord, where interruptions and new contacts occur. This happens especially in the upper enlargement of the cord (medulla), and in the large basal ganglia attached to the base of the brain (optic thalimi and striate bodies). In fact the enlargement and the presence of grey matter at these places, is due to the great numbers of these interpolated cells. This interrupted, or make and break plan, is illustrated schematically in Fig. 12, where from the skin (Ep) the stimulus follows NI thro the spinal ganglion (GS) into the cord, there branching down as well as up and sending off many fine side branches. The main stimulus going upward, however, it passes by contact to an intermediary cell in one of the gray enlargements of the cord (NG-B), going thence by N2 to another interruption in one of the large basal ganglia in the brain (Th), so that proceeding by another cell and fiber N3, the stimulus finally reaches the surface of the large brain (EC). Thus the hearing stimulus is interrupted three times in the medulla within the short distance of about four inches from its real sensory cells in the axis of the cochlea.* Each cell body with its shorter intaking arms (dendrites) and longer out-carrying arm is a complete unit in the chain thro which the stimulus is propagated. So instead of the older idea of the cells' fibers being really grown together in a network whereby the stimulus is propagated along continuous fibers, the newer evidence is against this and in favor of the separate individuality of each cell and its prolongations (called altogether a neuron). For receiving the transmissions by contact, the cell body and its dendrite arms have no insulating white covering, but consist merely of sensitive grey nerve matter. The cell's longer neuraxon arm, however, takes on a white insulation at a short distance from its cell, so that its stimulus can keep a distinct course from adjacent masses of fibres. At its end, tho, the neuraxon loses its insulation so that its gray branched endings can touch the grey matter of the cell and so transmit its stimulus.

The great importance of these interpolated cells is that their function is apparently not so much as relay batteries, —for there are long continuous fibres of even a yard in the leg, —but more as switchboard stations where other connections can also be made. So that, for example, in the third interruption of the sensation of hearing (in the posterior pair of the

*See Kölliker: Handbuch der Gewebelehre. 1893. Bd. 2, s. 397; also VanGehuchten: Le systeme nerveux de l'homme. 1893. Fig. 482:—both after Held.

corpora quadrigemina) the stimulus can make reflex connections for turning the head and eyes in the direction of the sound (and with some of the lower animals their ears also), or a reflex start at a sudden or loud noise; all this happening before the stimulus has gotten along to its end station in the brain and so given us knowledge of the noise.

This leads one to the question,—if the cells of the sensory system for taking in the stimuli of the world about us are all outside of the brain and spinal cord (cerebro-spinal system),

FIG. 13.
Hor. section of part of spinal cord, showing motor cell (cat). x 75.

what function have the some 3,000,000,000 cells of the cord and brain? First of all there is the part concerned as above in the interrupted propagation up to the brain of the stimuli from the senses, and since they thus also make possible more manifold connections, they can be called conduction and association cells. A second part of the cells in the cord have the function of connecting the two halves of the cord together (commisural cells and fibres), or of connecting different levels of the cord together (system cells or intrinsic cells of the cord), both of these classes of cells being for the general function of association.

MOTOR SYSTEM.

The rest of the cells in the cord and some in the medulla (connected with the motor part of the cranial nerves) are concerned directly with our movements and so are motor cells. The cells in the forward horns of the grey matter of the cord are thus for receiving the direct contact of the sensory fibres (as in CA of Fig. 12) and thus producing a reflex action of the muscle (M), or for receiving varying degrees of indirect stimulus up to voluntary action, in which the stimulus comes down from the

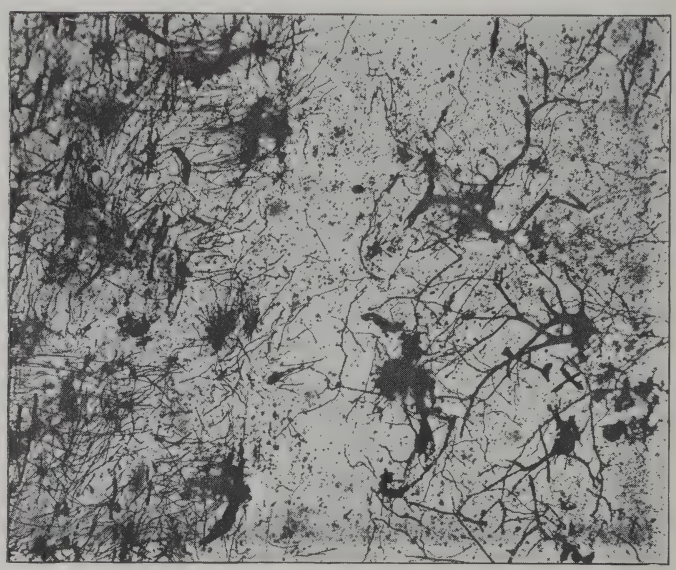


FIG. 14.
Vertical section of part of spinal cord, showing motor cell (cat). x 75.

pyramid cells of the large brain (EC, and by the fiber (NI) and thus finally acts on the direct motor cells (CA). One of these motor cells is shown in a horizontal view in Fig. 13,* and another in a side view in Fig. 14, (both above x), showing how the arms (dendrites) of these multipolar cells branch out in every direction to take in stimuli and having a single arm (neuraxon) to carry the stimulus out to move the muscle (not shown in the photographs). The end plates of these motor nerves in the muscles are seen in Fig. 15, where a branch is

*All the micro-photographs in this article are from original negatives and mostly from original preparations. The negatives were taken with a magnification usually of 100 diameters; and most of the reproductions here in half-tone are reduced one-quarter and thus give a magnification of 75 diameters. The irregular patches in the pictures of the cells are from precipitations of the sublimate or silver stain and are not to be confounded with the cells and fibers.

seen going off from the main nerve to each of the muscle fibers and ending in an irregularly shaped plate.

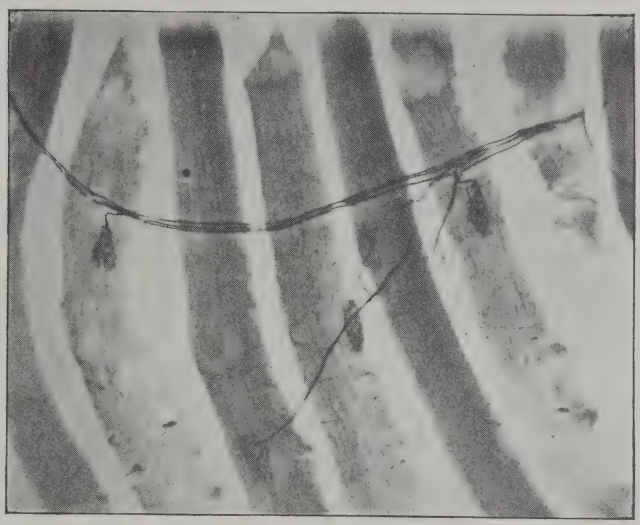


FIG. 15.
Nerve endings in muscle fibres, (rattlesnake). x 75.

CEREBELLUM.

Ascending the cerebro-spinal system the cells in the small brain (cerebellum) have been discovered by the late workers in nerve Histology to present the most wonderful apparatus for making connections and co-ordinations. In the schematic Fig. 16, the incoming sensation nerves are represented by n and h, the outgoing (indirect motor) stimuli proceed from the peculiar Purkinje cells, a, downward through its neuraxon, o. The incoming sensation is also represented in Fig. 12 as taken by an intermediary cell at cc in the cord via the dotted line to the surface of the small brain, EcV. The connection of the incoming sensory stimulus with the out-taking Purkinje cells occurs either by direct contact, as the "climbing fibres" (n) really climb up the main branches of the Purkinje cells, or indirectly again by means of intermediary cells. A photograph of two Purkinje cells is shown in Fig. 17, with their oval bodies and the hedge-like thick branches for taking in stimuli (dendrites). The arms for the out-going stimuli (neuraxons), are shown in Fig. 18, where the single fiber is seen coming off from the base of each of the oval bodies of the cells, curving

upwards to the left, and sending off a few side branches (collaterals). The prolific dendrites of the Purkinje cells are, however, a very thin hedge and really more fan-like; for when a section of the small brain is cut parallel to the surface, these cells look much like poplar trees. In Fig. 19 the oval bodies of five of these cells are seen in a row, with their dense and rough mass of dendrite arms stretching as always towards the surface. If we look at Figs. 17 and 18 from the edge, i. e., at right angles to their present cross-section plane, they would look like Fig. 19.

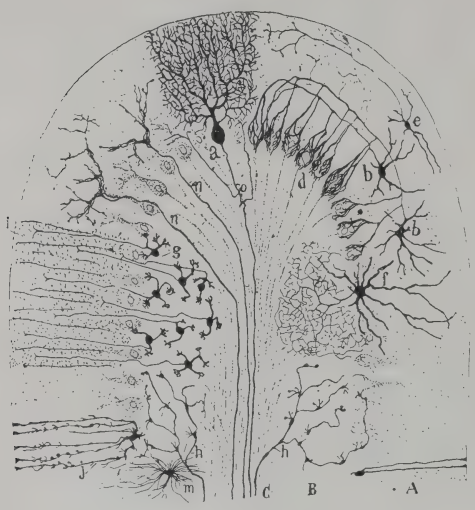


FIG. 16.
Half schematic section thro a convolution of the cerebellum of a mammal.
From R. y Cajal: Neue Darstellung von histologischen Bau des Centralnervensystems. His' Archiv fur Anatomie (und Physiol). 1893. Fig. 8.

Now tho these Purkinje cells stand so near together that the hedges of dendrites touch and intermingle, yet there are two apparatus for apparently connecting them together. The cells like b in Fig 16, have a long arm from which branches drop down and with their many-tendriled endings cluster around the bodies of the large Purkinje cells, a. Thro the middle of Fig. 20 are seen the bodies only of about eight Purkinje cells, around which come down from the transverse fibers just above them, these basket fibers, as they are called. Tho the cells from which these basket fibers come are unfortunately not seen in the photograph, a somewhat similar one is seen in Fig. 21, where the little cell above x has two long arms, besides several short ones,—one going on around the curve of the convolution, the other going to the left even farther than shows in the plane of the photograph. Tho the space covered by these arms is actually less than 2 mm. (⅛ in.), yet this reminds us of the comparatively enormous amount of matter which is in the arms of a cell, as compared with its body from which the arms have grown out. There can thus have developed

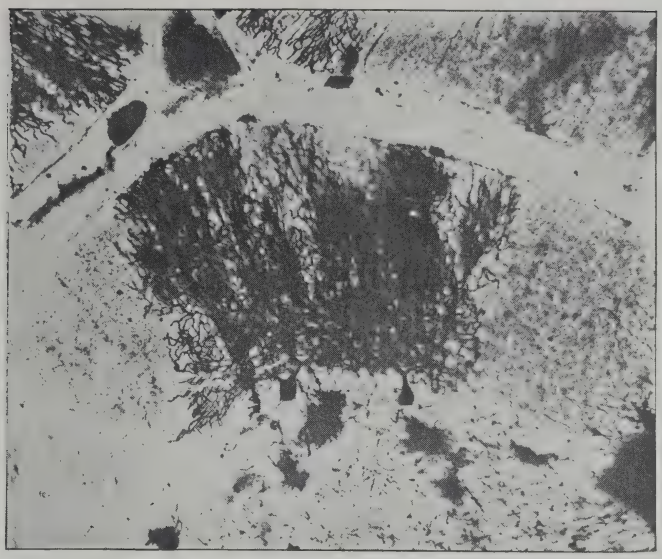


FIG. 17.
Vertical section thro cerebellum convolution, (human). 2 Purkinje cells. x 75.

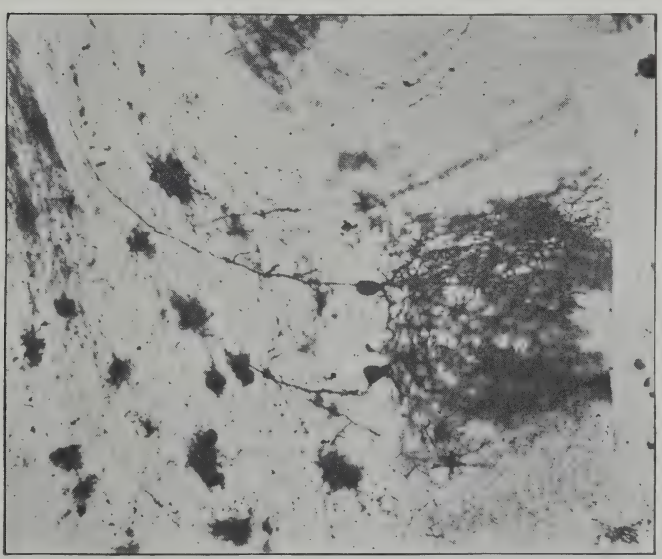


FIG. 18.
Cerebellum cortex (human). Outgoing (neuraxon) fibers from Purkinje cells. x 75.

about 375 times as much matter in the arms as is in the body. (Donaldson: Growth of the Brain, p. 154). The other special association apparatus starts from the little granular cells, g, in the lower layer, B, of the gray matter; the arms from which go up towards the surface and then bifurcate out in a plane vertical to the plane of the figure. Thus these long double arms run parallel to the surface (in the plane of Fig. 19) thro the dendrites of the Purkinje cells like a lot of telegraph wires running thro the branches of trees which are all spread out in a plane across the street. Besides these two systems of asso-

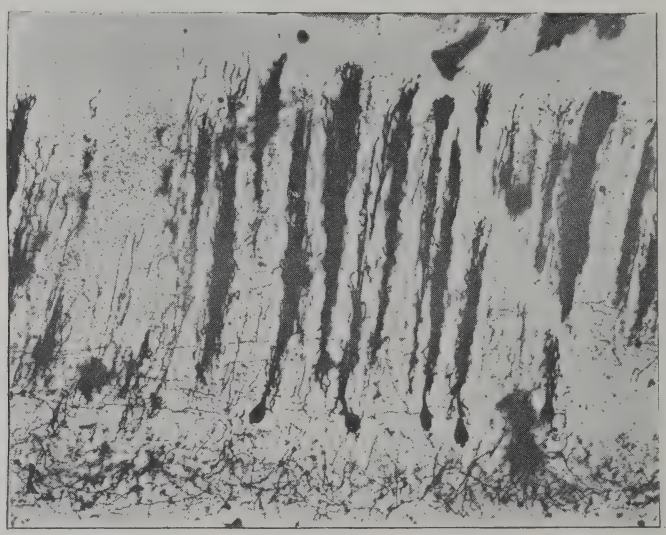


FIG. 19.
Section of Cerebellum cut parallel to convolution, (human). x 75.

ciations crosswise and lengthwise of the convolutions of the small brain, there are also some larger cells, f, which, with the prolific subdivision of their neuraxon among the granular cells, seem to be an extra means of association.

With some such mental picture then of this most wonderfully complex part of our nervous system, we can now place the small brain in its real connection with the entire three-fold function of the nervous system. And when we remember that the small brain has three pairs of fiber bundles connecting it with (1) the cord below, (2) the cord immediately under it (thro the Pons), and (3) with the large brain above, and when we find that there are in-coming and out-going fibers in each of these connections, then one realizes that with its physiolog-

ical function as a co-ordinator of our muscular movements the small brain is a highly complex intermediary apparatus for taking in the sensory stimuli directly from the cord below, or by circumlocutions from the large brain above, for associating this together with marvellous intricacy, and for sending out the resulting combinations to move several muscles in usefully co-ordinated movements.

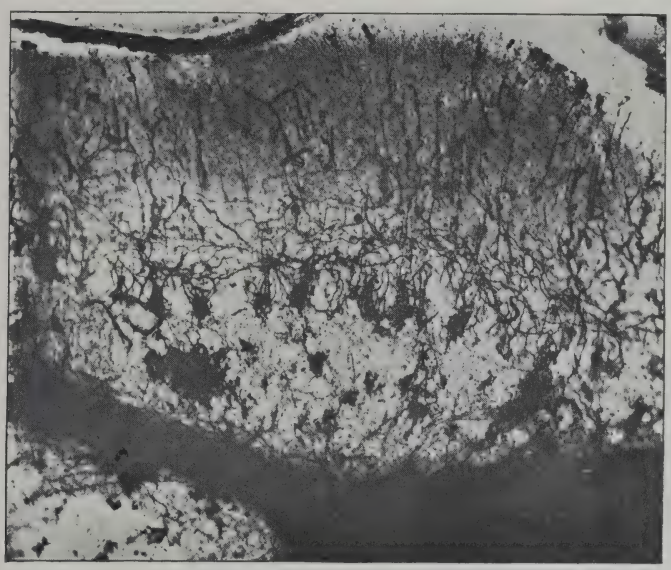


FIG. 20.
Cerebellum (Dog). Showing basket fibres. x 75.

As the outgoing neuraxons of the Purkinje cells do not connect directly with the muscles, but only indirectly thro the real motor cells in the medulla and cord, the whole cerebellum is an intermediary association apparatus. And tho it works without consciousness, and we have hitherto not been inclined to think of our muscular movements as a part of our mental life, yet all our modern psychological study is showing more and more the intimacy and necessity of the movements of our bodies for our doing any thinking and for executing our pleasure-pain feelings. The co-ordinated movements of both eyes for sight; the adjustment of the head for seeing and hearing; the movements of the jaw, tongue and throat for tasting and for the great art of communication by speech; the complex movements of the facial muscles for the expression of the

emotions; the incomparable craft of the human hand; the great art of locomotion for bringing the adult as well as the infant into wider contact with the world about; and finally the fact of the tendency to express all our thoughts and feelings in movements and that only thro movement have we knowledge thus indirectly of other bundles of consciousness besides our own:—such newly studied facts increase our wonder and respect for our motor life and thus should give us a deep admiration for its newly discovered mechanism.

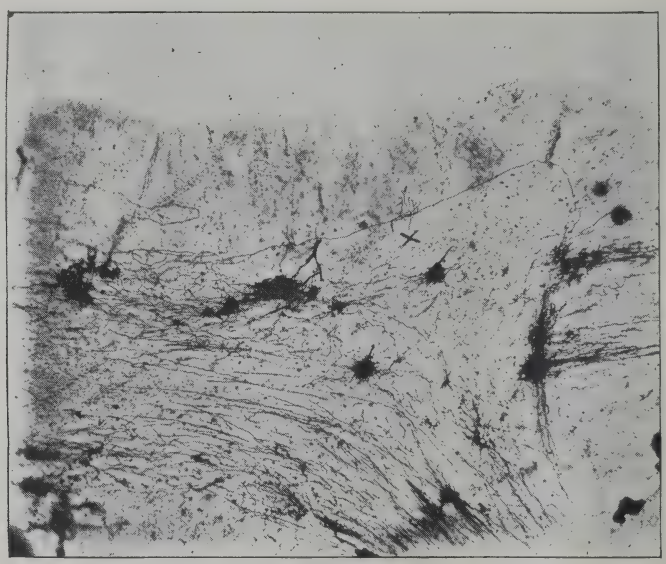


FIG. 21
Cerebellum (Human). Small association cell with two long arms. x 44.

CEREBRUM.

When we follow the incoming sensory stimuli in their interrupted course up the cord, thro the isthmus in the large basal ganglia of the brain (internal capsule), and their radiations to the separated sense areas on the surface of the large brain (cerebrum cortex), there we come to the chief center of interest from the psychological point of view. Because here somehow these sensory stimuli at last become knowledge, are stored away for repeated use (memories), become associated manifoldly together, get a feeling tone of pleasure or pain, and according to this send down a motor response. But tho this important added element of consciousness is present, yet the

general plan of the nervous mechanism is the same as in the unconscious small brain, or even in the simple reflexes of the cord.

In the schematic plan of the ⅛ in. thick grey surface of the large brain (cerebrum cortex) in Fig. 22 the incoming sensation fibres are represented by Rf and Af, with their branches up among the cells. A truer picture of the inextricable mass which can be formed by the fibres bringing in sensations and some of the neuraxons of local cells for further associating the sensations together is given in Cajal's late Fig. 23, of these fibres in the

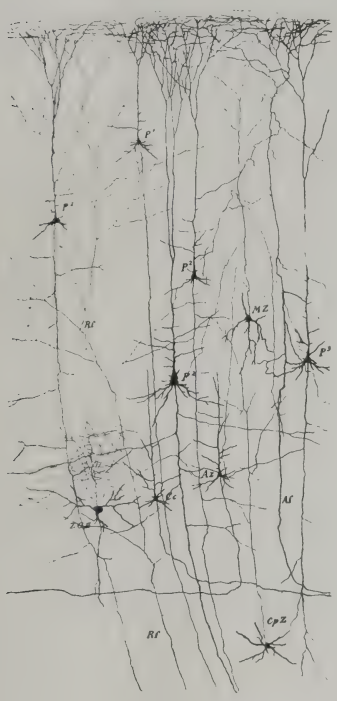


Fig. 22.
Schematic plan of the most important elements of the cerebrum cortex.
From Koelliker: Handbuch der Gewebelehre des Menschen. 1893. 2te Bd Fig. 745.

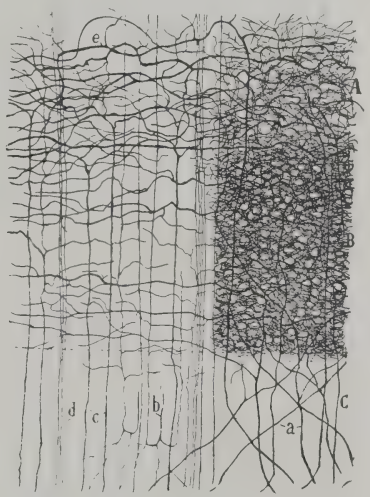


Fig. 23.
Nerve plexus of sensory fibers and neuraxons in the 4th and 5th layers of the visual cortex of an infant aged 20 days.
From Cajal: Comparative study of the sensory areas of the human cortex. Decennial celebration of Clark University. 1899. Fig. 18.

sight center. The oval spaces between the meshes in A and B one must imagine filled with the bodies of association cells. The cells thus receive the stimuli directly by the fine sensory branches touching their bodies, or touching their long apical split-end arms (dendrites) extending upwards toward the surface of the brain (as the cells p in Fig. 22) or touching the other dendrites from the body or base of the cells. The outline plan is then completed

by the single out-going fiber with some offshoots (collaterals), conducting the stimulus downward. The main characteristic type of pyramid cells with their triangular or pyramid bodies are much more prolific in dendrite arms than the pictures usually given in the schematic drawings. Specially from the base are from a half to a full dozen of these intaking arms in a single plane, as in Fig. 24, in the smaller pyramids of Fig. 25, and the single very prolific one in Fig. 26. In Fig. 27 are shown the bodies only, with some basal dendrites, of two giant human pyramids at A and B, while at C is an average sized pyramid cell. Another giant pyramid is shown in Fig. 28, in more nearly its completeness, and with some idea of the surrounding tangle of fibers. These pyramid cells do not, however, branch out in one plane like the hedge-fans of the Purkinje cells of the small brain, but when a section is cut parallel or slanting to the surface, one finds the basal dendrites at least, reaching out in every direction. In Fig. 29 one gets a slight idea of the tangle this can make where a section parallel to the surface chances to cut thro the bodies of only about 15 cells (the apical dendrites of these cells would be pointing toward us.) The clearest single body of a pyramid is seen near A, where seven dendrites can be seen in this chance plane alone.

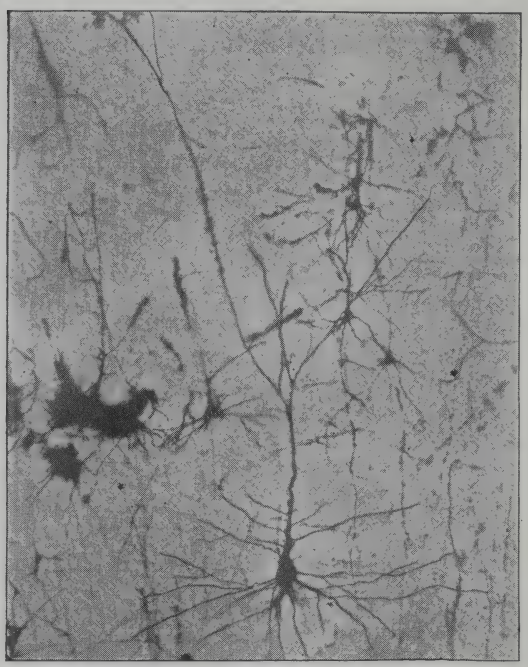


FIG. 24.
Cerebrum cortex (Cat.) Giant pyramid cell. x 75.

In the lower part of the grey cortex lies a stratum of irregular shaped cells, of which a good sample is shown in Fig. 30, at A, with a long branch bending upward, another downward

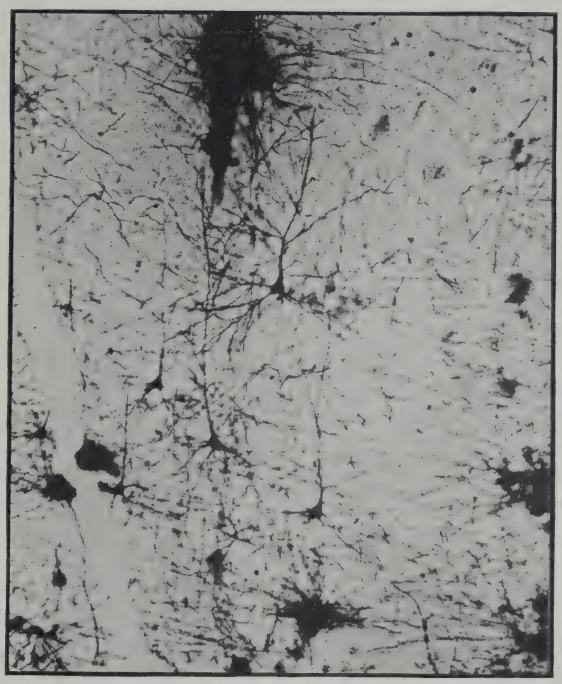


FIG. 25.
Cerebrum cortex (Human.) 5 pyramid cells. x 75.

FIG. 26.
Cerebrum cortex (Human). Pyramid cell with many basal dendrites. x 75.

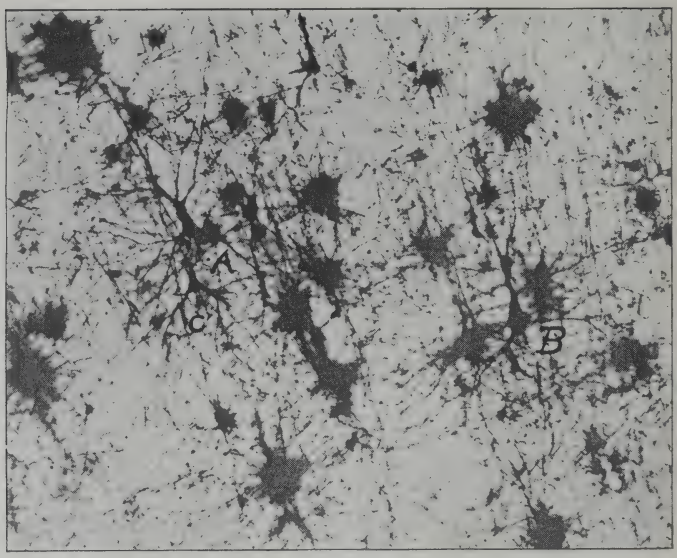


FIG. 27. Cerebrum cortex (Human). Bodies of two giant pyramid cells. x 75.

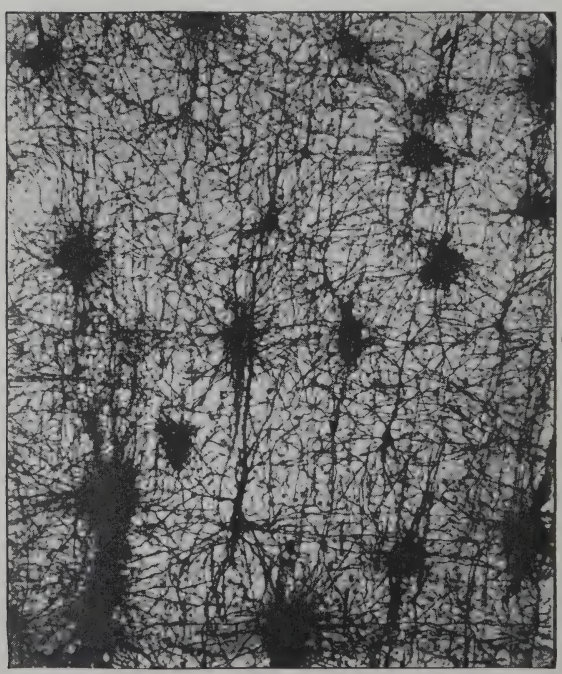


FIG. 28. Cerebrum cortex (Human). One giant pyramid and five average ones. x 75.

to the left, and another downward to the right, all with many side branches and subdivisions. Some other special cells are shown in Fig. 22 at ZGII and MZ, the former being an irregu-

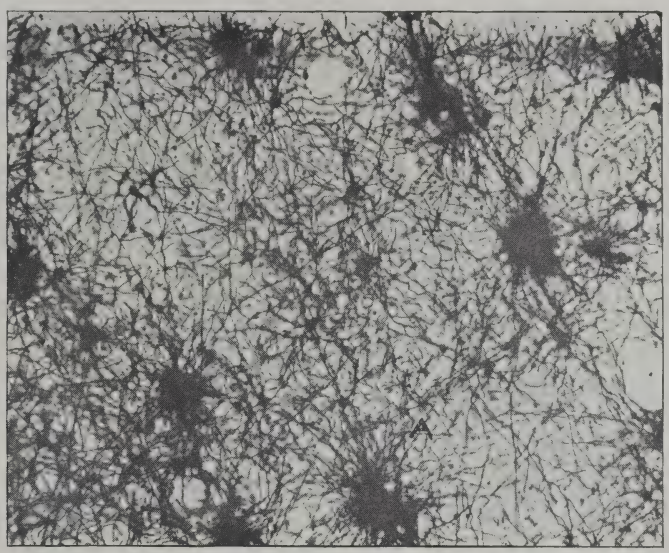


FIG. 29
Cerebrum cortex (Human). Section parallel to surface, cutting the bodies of fifteen pyramid cells. x 75.

lar cell body with a short but prolifically subdivided neuraxon running upward instead of downward, while the latter has the usually formed neuraxon also turned upward. One of the late discoveries of Cajal is the presence in far greater numbers than had been supposed of these stellate cells with their comparatively short neuraxons running up or down. These in Fig. 31, together with the bipanicled cells E and F, are specially frequent among the endings of the sensory fibers (in Fig. 23), and are characterized by their discoverer as "special cells of association." From them we may see "how many paths nature has opened up to render association of nerve impulses possible in every direction and thro any distance. That which proves the importance of these association cells and leads us to the surmise that they play an important psychic role is the fact that they are extremely numerous in the human brain. They are found in the animal brain as well, but are not so numerous and are usually confined to the boundary of the first layer."*

*Cajal: Comparative study of the Sensory Areas of the Human Cortex. Decennial Celebration of Clark University. 1899, pp. 334 and 335.

In Fig. 32, made up of micro-photographed samples of cells from the large brain, are some irregular cells very near the outer surface (Cajal cells), in which run longitudinal fibers apparently connecting together the fibrilated ends of sensory nerves coming up that far, and quite a forest of the tops of the pyramid dendrites. The far greater complexity and importance for association of this outer cortex layer has also been lately shown by Cajal. (Ibid. p. 323.)

FIG. 30.
Cerebrum cortex (Human). Fusiform cell in lower layer. x 75.

Thus, altho there are about a half dozen typical forms of cells in the cerebrum cortex, by far the most numerous and important are the pyramid cells. The photographs given do not give any idea of the number of these cells; for with the sublimate or silver methods of staining used in the above cuts, only chance cells have been stained. But by another stain (hämatoxylin) only the bodies of all the cells show as halos about the dark nucleus, as in Fig. 33. In this section about 1000 cells can be counted; and when one tries to realize this number in the actual disc of grey matter 1 mm. in diameter and 0.05 mm. thick, i. e., less than the diameter of the head of a pin or the lead in a lead pencil and thinner than the thinnest paper, and then tries to imagine how many such discs can be made up

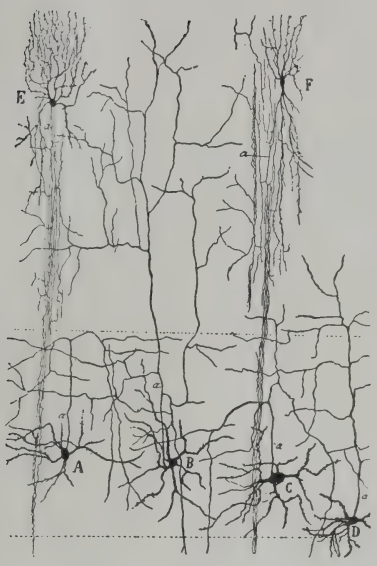


FIG. 31.

Cells of the visual cortex, infant fifteen days old, 4th layer.

A, B, C, D,—stellate cells with ascending neuraxons, a.

E, F,—small bipanicled cells, with greatly subdivided neuraxons, a.

From Cajal: Ibid, Fig. 23.

from the entire cortex amounting to a square about a half yard on a side and ⅛ inch thick, one then begins to get some little conception of the enormous and practically inconceivable number of these brain cells. Meynert's estimate of some 1,200,000,000 cells in the cerebrum cortex only intensifies our helpless amazement at this marvellous apparatus.*

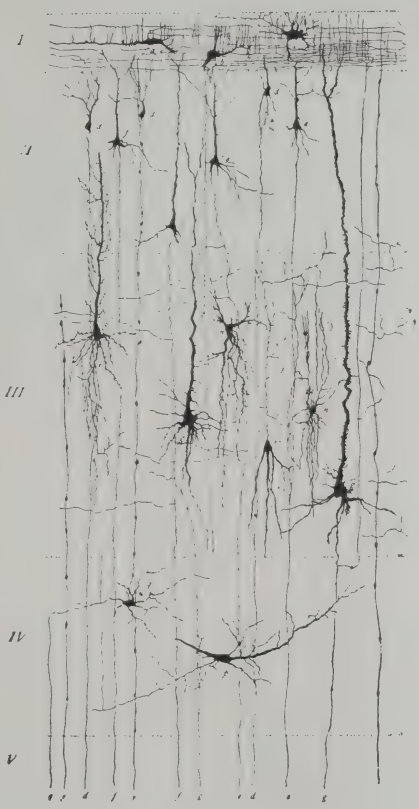


FIG. 32.

Diagram of cells of the cerebral cortex: from micro-photographs.

From Starr: Atlas of nerve cells. 1896. Fig. 10.

The importance of these pyramid or psychic cells, as they are coming to be called (Cajal, Kölliker), is shown in the general parallel of the increase in the number, size and complexity of these psychic cells, with the increasing intellectual position in the animal scale. In Fig. 34, the great Spanish discoverer shows in the upper row the increasing development of these psychic cells thro the frog (A), lizard (B),

*A late estimate multiplies this older one some eight times, making some 9200 millions, which is probably nearer the fact. Thompson: The total number of functional cells in the cerebral cortex of man, etc. Journal of Comparative Neurology. June 1899. Vol. 9, No. 2, p. 128.

mouse (C), to man (D). In the lower row is shown the stages in the growth of the individual cell, which first sends off its out-taking neuraxon (a), then the apical dendrites start upward (b), and after this has acquired considerable extension and subdivision, appear the dendrites from the base (e). Cajal says that "one can therefore infer that probably the psychic cell performs its functions the better and more thoroughly the greater the number of protoplasmic processes going out from the body, or as side branches, and the more richly and embracing the collaterals of the axis cylinders (out-going neuraxons) subdivide."* One sees at a glance the importance of the size of the pyramid cells and their consequent branch development, in a comparison of the following two Figs. 35 and 36, where Fig. 35 shows the bodies merely of the cells in four different sections of the large brain of a normal man, while Fig. 36 shows sections from the brain of a mod-

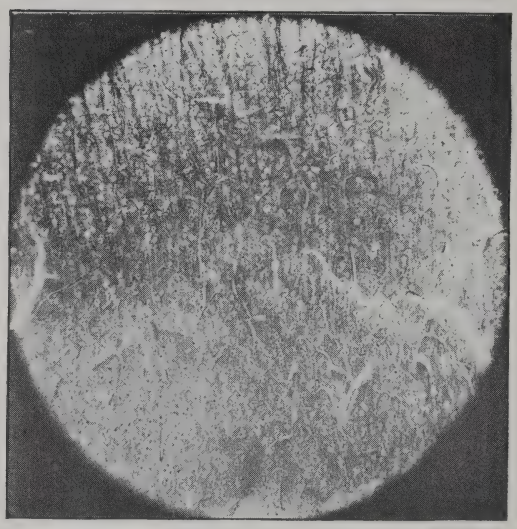
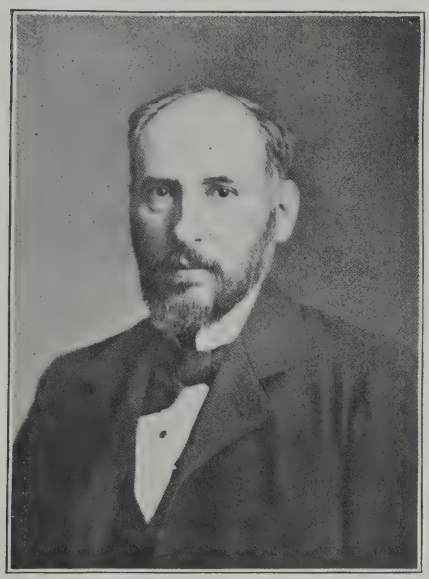


FIG. 33.
Cerebrum cortex (Human). Bodies of about 1000 nerve cells. x 75.

FIG. 34. Pyramid or Psychic cell in the vertebrates. (A) Frog, (B) Lizard, (C) Mouse, (D) Man. A Pyramid or Psychic cell in stages of growth, (a) to (c). From Cajal: Neue Darstellung Ibid. Fig. 13.

*Cajal: Neue Darstellung vom histologischen Bau des Centralnervensystems Archiv fur Anatomie und Physiologie. Anat. Abth. 1893. s. 375.

erate imbecile (two lower sections) and from an idiot (two upper sections). The top section in Fig. 35, and the next to the bottom in Fig. 36, are from the corresponding region of the brain (upper temporal region of hearing); and while both show almost the same number of cells (369 and 375), yet the imbecile's cells have evidently stopped in their growth in size and in the development of dendrites and neuraxons. For as the production of new primitive brain cells stops in about the third month of fœtal life, the subsequent growth of the nervous system is the development of this primitive stock of germinal cells.* Thus Hammerberg has shown that the arrested mental life of the imbecile and idiot is caused by an arrest in the development of the cells of the cerebrum cortex.†



Santiago Ramon y Cajal.
Professor of Histology in Madrid.
From photogravure in Decennial Celebration of Clark University.

If we have now formed some outline conception and a slight mental picture of the enormously intricate mass of cells and fibers making up the organism of our large brain, we naturally ask again,—What in particular do these cells and fibers do? This is our chief scientific interest after all, and one of most vital practical importance. Here, however, as in other fields of the knowledge of our organism, the anatomy has preceded the physiology. But we have lately had most clarifying light thrown on this dark subject. For the great center of the Psychological Congress of some five hundred members in München in 1896 was the rugged figure of Paul Flechsig, Professor of Psychiatry in Leipzig, who showed his

*Donaldson: Ibid. p. 160.

†Hammerberg: Studien über Klinik und Pathologie der Idiotie. Upsala, 1895. p. 121.

brain sections and explained his now famous theory of association.* By getting stained sections thro the full brains of the human fœtus and child at successive ages, when different nerve tracts develop successively and can thus be followed separately, he showed that the incoming fibers with the med-

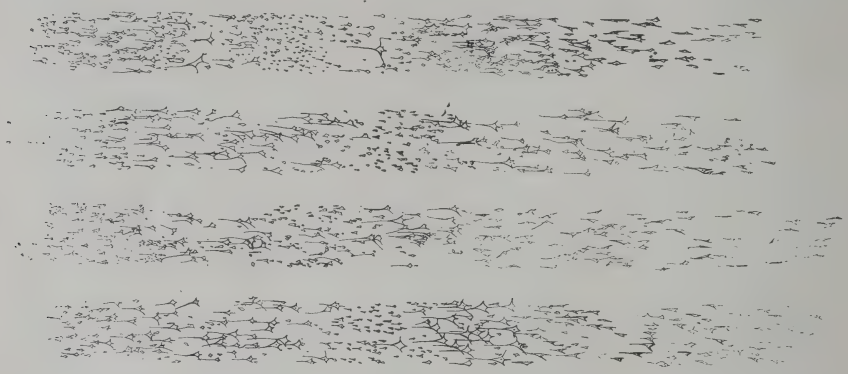


FIG. 35.

Section through the Cerebrum Cortex of a normal man, showing number and size of cells.

From Hammerberg: Studien über Klinik and Pathologie der Idiotie, nebst Untersuchungen über die normale Anatomie der Hirnrinde. 1895. Taf. 2.

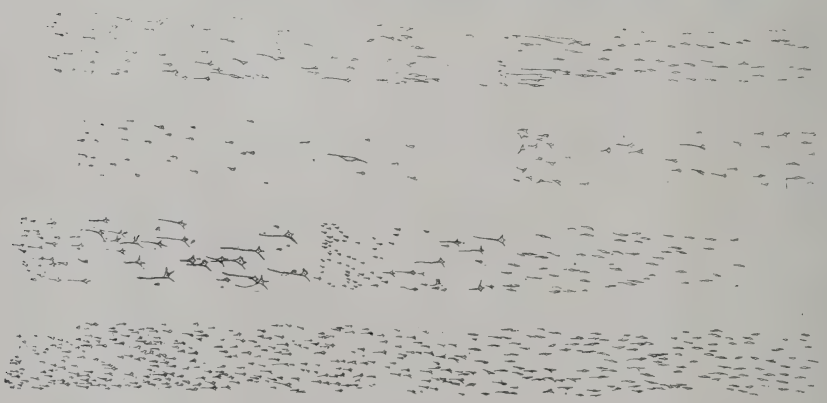


FIG. 36.

Sections thro the Cerebrum Cortex of an imbecile and idiot, showing the small size of the cells. From Hammerberg: Ibid. Taf. IV.

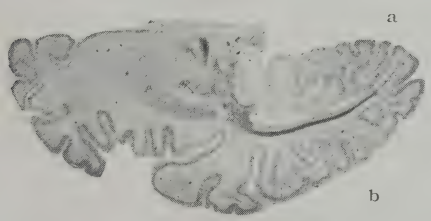
iated sensory stimuli is toward and into quite widely separated and well defined areas of the cortex. Thus in the horizontal section of the child hemisphere one week old, in Fig. 37, the fibers (stained black) bearing sight stimuli are seen running

*Originally made public in his inaugural lecture, "Gehirn und Seele," as Rector of the University of Leipzig in 1894, but published with extensive notes and plates in 1896.

backward to the sight center, where they would end as in Fig. 23. A faint bundle of fibers is seen making downward for the hearing center in the temporal region, but not yet attaining it. In a vertical section of a one month brain, in Fig. 38, some fibers are found grown into the sight area about the important calcarine fissure, to the touch area about the prominent central or Rolando fissure, and some interruptions below of the tracts for smell. The paths for the mediated stimuli from the sense organs thus grow separately and successively toward and into the surface of the large brain,—the first in time being the smelling tracts and last the hearing tracts.*

PAUL FLECHSIG.
Professor of Psychiatry in Leipzig.
From photograph by Brokesch, Leipzig.

In Figs. 39 and 40 are shown the four centers to which the stimuli from the senses are finally taken; taste being probably taken to the smell center, corresponding to the fact that most of our apparent taste is really a large variety of odors and to our having only four real tastes.

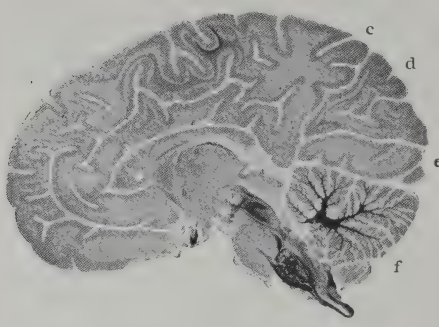


a. Sight fibers, black.
b. Hearing fibers, incompletely developed.
FIG. 37.
Horizontal section thro the hemisphere of the brain of a child one week old. About ½ natural size.
From Flechsig: Gehirn and Seele, 2te verbesserte mit Anmerkungen and 5 Tafeler verschene Ausgabe. 1896. Taf. II. Fig. 4.

But one is struck with the fact that only about one-third of the surface of

*As a part of a large mass of daily observations and records on our three children, Mrs. Gale and I have found that our records of the earliest associations, classified as to the senses between which the associations occur, correspond in general to Flechsig's anatomical progressive brain growth.
An excellent presentation of Flechsig's work is given in English in an article by Professor L. F. Barker: The Sense-Areas and Association-Centers in the Brain as de-

the child's brain is thus pre-empted by the sensation-bringing tracts and asks: What then, becomes of the other two-thirds of the brain surface? Flechsig's epoch-making answer to this was the explanation that from cells in these sense centers there begin to grow out in the second month fibers into the intervening regions, until the fibers from two or more sense centers meet in some of this originally unoccupied midway territory. Thus the sense stimuli become finally associated together and thinking begins. And the two-thirds area of the brain surface, which had no developed nerve tracts in it when the in-coming tracts to the sense centers were ready for use, is gradually filled up with tracts connecting together the sen-



a. and b. Touch fibers, the darkest. c. and e. Cuneus sight center. d. Sight fibers. e. Calcarine fissure. f. Cerebellum.

FIG. 38.

Vertical length section thro the brain of a child one month old. About one-half nat. size. From Flechsig: Ibid. Taf. 1. Fig 1.

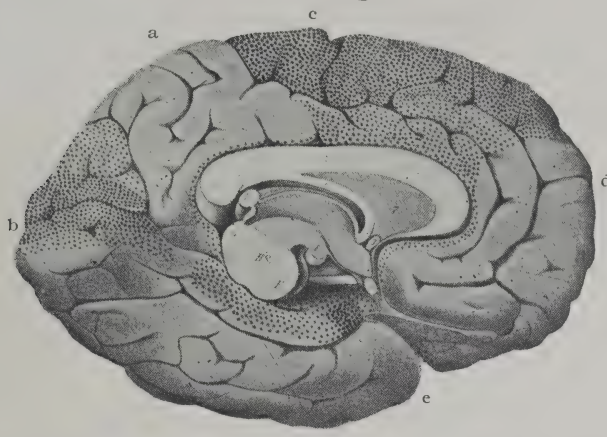
a and c. Posterior association center. b. Sight center. d. Bodily sensations (touch) center. e. Frontal association center. f. Island of Reil, middle association center. g. Hearing center.

FIG. 39. Brain of a child (about two months) the sense-centers being dotted, the association centers being the not-dotted surface. From Flechsig: Ibid. Taf. IV. Fig. 7. ¾ nat. size.

sation data of knowledge. Three general association or "thought centers," as Flechsig calls them, are thus made out

scribed by Flechsig; in the Journal of Nervous and Mental Disease, June, 1897, Vol. 24, pp. 325-356.

of the larger part of the surface of the brain: (1) a frontal, forward of the body center; (2) a middle or insular, being the Island of Reil (seen by pulling the brain apart at the fissure of Sylvius); and (3) a posterior, including all the parietal, occipital, and temporal region between the body and sight centers, and around under the hearing center. In a later communication Flechsig announces that from the added study of the sections for forty-eight brain hemispheres from a seven months fœtus to a year and a quarter child, he can make many subdivisions of these centers and the adjacent territory.* Thus he makes about forty subdivisions,—somewhat arbitrary, to be sure, in their exact limitations, but based on more exact evidence of the progressive growth of the association tracts binding the sense centers together.



a. Posterior association center. b. Sight center. c. Bodily sensations (touch) center. d. Frontal association center. e. Smelling center.

FIG. 40.

Brain of a child, medial surface; the sense centers being dotted, the association centers being the not-dotted surface. From Flechsig: Ibid. Taf. IV. Fig 8. ¾ nat. size.

FIG. 41.
Long tracts of association fibers.
From Dejernie: Ibid. Fig. 377.

The existence of large and long bundles of tracts appar-

*Flechsig: Neue Untersuchungen über die Markbildung in den menschlichen Grosshirnlappen. Neurologisches Centralblatt. Nov. 1, 1898. Bd. 17, s. 977-996.

ently for association was by no means new, for Meynert had pictured them by breaking apart hardened brains and had named them "association tracts."* Some of these bundles are shown half schematically in Fig 41, as if looking transparently thro the side of the brain and a short distance beneath the surface. But Flechsig's great service has gone beyond this in giving us a general correlation in the brain growth of the infant with its simple but rapidly growing mental life; he has shown the larger part of the brain to be reserved for that great function of association, which is the psychological basis of all our thinking beyond mere sensation and of the whole substance of reasoning. Therefore, he justly calls these association regions of the brain "thought centers." Their activity is accompanied with all degrees of consciousness, even to being in large part unconscious; but thro their mechanism results the unity of consciousness and of personal identity. Also as the director of a large clinic for nervous diseases, he is showing inversely that the disease and degeneration of the thought centers is the chief cause of insanity.† On the positive side he suggests, with some evidence, that the high intellectual or artistic ability of genius, is characterized by unusual development of these thought centers.‡ Thus he opposes the modern sensational degeneration theories for genius, and in addition to his own observations on the large development of the thought centers of Bach, Beethoven, Wagner, Gauss, and Helmholtz, he will stimulate to more such careful studies as that of Prof. Hansemann's on the brain of Helmholtz.§ Also he has suggested that when we look at the vertebrate animal series, we find in general that from those acting with lower intelligence up to higher, there corresponds an increasing separation of the sense centers, which in the lowest animal intelligence are crowded together in immediate contiguity to each other. So that with an increasing ability to react thro its mental life for its better adaptation to its environment, there corresponds a separation of the sense centers in its brain, thro the increasing growth of the intervening thought centers. Such most important evolutionary evidence

*Meynert: Psychiatrie. 1884. pp. 38-42.

†Gehirn and Seele, pp. 24, and 87-96. In his subsequent lecture on "Die Grenzen geistiger Gesundheit und Krankheit," 1896, he says, p. 18: "Psychiatry is the knowledge of the variations of the mental life under changing bodily conditions. Therefore it must first of all join itself to the study of the brain; every kind of metaphysic acts here like a narcotic in confusing the clearness of our views."

‡Gehirn and Seele: pp. 30 and 102.

§D. Hansemann: Ueber das Gehirn von H. von Helmholtz. Zeitschrift fuer Psychologie und Physiologie der Sinnesorgane. 1899. Bd. 20. s. 1-12.

for the thought centers of the brain will undoubtedly be more specially studied. Already one of Flechsig's assistants has announced preliminarily, that from forty-five series of the brains of cats and dogs, as also from studies on rabbits, rats, mice, and Guinea pigs, he finds the same general principle of the order of growth of the sense centers, followed by the association centers.* These association centers seem also to be the basis for all our memories (as against the old idea of a special faculty of memory), as even the sense centers do not seem to retain the memories of their stimuli, but to store them up in the association regions adjacent to the sense centers.

The brain mechanism of our whole range of feelings of pleasure and pain, and their knowledge combinations into emotions, is mostly still in darkness. The body-touch center Flechsig considers as the center also for the bodily pleasure-pain, and so as being the chief organ in making up the individual character of each person.

In putting together all these elements of our nervous system for making a permanent outline picture of its structure and uses, a wonderfully helpful simplification has been made for us by Prof. His in tracing the embryological development of our nervous system. In Fig. 42 is shown the first beginnings of the nervous system in cross sections thro the three primitive layers of the egg; starting with the primitive groove (m) in the top of the first section, which groove is the first differentiation to appear in the egg. This groove deepens and the sides curve toward each other till in the two bottom sections it is shown grown together into a tube. This closed tube grows faster at its upper end than the rest of the embryo, so that in meeting obstacles in its

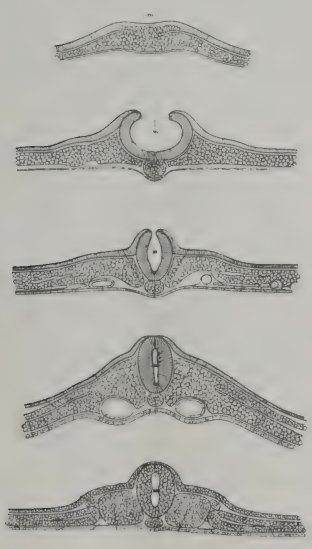
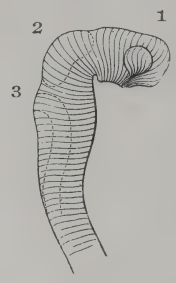


FIG. 42.
Sections thro the three embryonic layers, from the outer of which the primitive nervous groove and tube (m) develop. From Ranke: Der Mensch. 1894. Bd. 1. s. 138.

*Doellken: Die Reifung der Leitungsbahnen im Thiergehirn. Neurolosisches Centralblatt. 1 Nov, 1899. Bb. 17, s. 996-998. Also such independent works as Loeb: Einleitung in die vergleichende Gehirnphysiologie und vergleichende Psychologie, 1899, will be of great value in reconciling the evidence from the extreme champions of brain

naturally straight-forward growth the head end is bent somewhat similar to a stove pipe, as in Prof. His' Fig. 43. From



1, Fore-brain. 2, Mid-brain. 3, Hind-brain

FIG. 43.

Pipe bent after the manner of the embryo brain.

Brain end of the nerve tube of a human embryo of about three weeks, with added cross lines. x about 12.

From His: Zur Geschichte des Gehirnes, etc. 1888. Figs. 12 and 13.

FIG. 44. Outer surface of the brain tube of a human embryo of 4½ weeks (model). x 10. From His: Address upon the development of the brain. Dublin. 1897. Fig. 23.

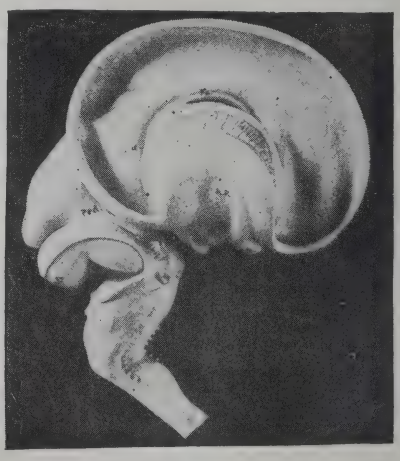


FIG. 45. Brain of human embryo of the third month, with the outer surface of the brain sac cut away. (model). x 2½. From His: Ibid. Fig. 27.

localization and those of non-localization. After his most interesting reaction experiments from the medusa up thro worms and mollusks to dogs, his main conclusions are that "living beings are machines and must be analyzed as such if we wish to gain an understanding of their reactions (p. 130). The role of the nervous system consists therein, not that it contains a mechanism for regulation, but that the conduction of the stimuli take place quicker, and that it therefore allows the peripheral organs to work with greater precision (p. 28). All experiments thus prove that the large brain of the vertebrates is indispensably necessary for the processes of associative memory and of consciousness, (p. 166). What one today calls the centers of the cerebrum cortex are only the inpouring regions of the fibers which bind the large brain with the segmental ganglia," p. (168); which segmental ganglia plan the author has followed up thro the animal scale and applied to the vertebrates and to man.

this bending and the uneven thickening of the wall of the tube, there thus appear three enlargements in the head of the em-

bryo, the rest of the tube down the back remaining about equal in its smaller diameter. As the end enlargement (1) grows so prolifically as to form a sac or pouch on both sides, these pouch-growths of the tube wall are forced by the surrounding resistance to fold back more and more, as seen in Figs. 44 and 45, until the sacs have covered back over the enlargements (1) and (2). In their continued disproportionate growth the sacs are forced into many deep folds until they form the convoluted hemispheres of the large brain. Thus the outwardly so complicated form of the brain is only the disproportional growth and resulting folding back upon itself, of the upper end of the primitive nervous tube, which lower down retains its simpler tube form as the spinal cord.

Similarly the inward structure of this primitive tube has developed on a very simple and uniform plan; for the cells which start from the canal sides of the tube wall and move toward the outside first show a single nerve fiber growing out from one end of the cell, as in Fig. 46. (As also in the lower row in Fig. 34). Most of these fibers turn forward and, breaking out of the tube in quite a mass, grow into the muscles, thus forming the motor cells and fibers. The other nerve cells whose fibers remain within the walls of the tube serve either to connect the two sides or halves of the tube together in cross sections, or, as longitudinal fibers, to connect together different levels of the tube. Now even with the increasing bushiness, along with their greater age, of the other dendrite processes of the cells and with the increasing variety of the individual cell shapes, especially in the large and small brains grown from the first and third enlargements of the tube, we do not know of any new cells to develop within the cerebro-spinal system any

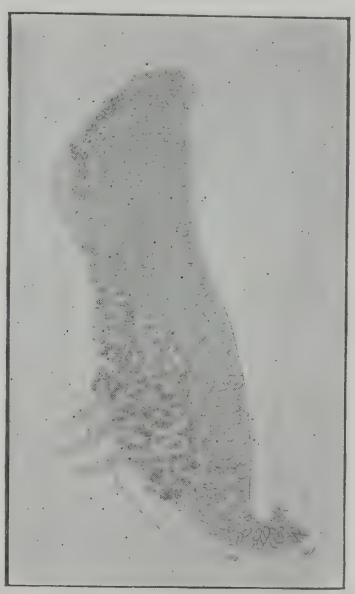
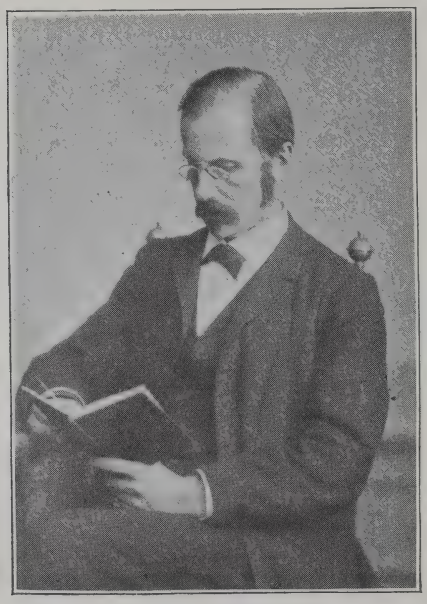


FIG. 46.

Section thro half of the spinal tube of a human embryo of about 4 weeks. x 140.
From His: Zur Geschichte des Ruckenmarkes, etc., 1886. Taf. I.

different from these two types of primitive cells, viz., (1) motor cells with fibers going outside of the tube to the muscles, and (2) association cells with fibers remaining within the tube. The only difference between the finally shaped brain end and the spinal cord end of the primitive tube is that the association cells begin to increase greatly in the thickening diameter of the cord (medulla oblongata or bulb) in the lower part of the enlargement (3), and form an immense proportion in the surface of the large brain (the pouches from enlargement, 1),—even if they should not all be classed as association cells. For if no cells above the spinal cord and the corresponding cells of the motor parts of the cranial nerves in the medulla are in immediate and direct connection with the muscles, then all the cells growing in the three enlargements of the primitive tube, and forming the small brain, basal ganglia, and large brain, would be association cells in the wide sense. For special identification all these general association cells can be subdivided into groups as (1) conduction cells of the second order, being those cells taking up the sensory stimuli at second-hand, third-hand, etc.; (2) mediate motor cells of the small and large brains, being the Purkinje and pyramid cells for sending downward stimuli to the immediate motor cells in the cord and bulb; (3) commissural cells, uniting the two halves of the cord or brain; (4) more strictly association cells, uniting the stimuli received thro the conduction cells to the mediate motor cells, and over all distances between very short intervening distances within the



WILHELM HIS.
Professor of Anatomy, Leipzig.
From photograph by Brokesch, Leipzig.

same convolution, to adjacent convolutions, and up to the widely distant sense centers.

The following Fig. 47 gives us a final scheme of the functionally different elements of our nervous system. For (1) in the ganglion outside the cord tube are the bipolar sensory cells bringing the sensations from the sense organs into the tube; within the cord tube are (2) the outgoing motor cells, (3) the association cells remaining within the tube for connecting (1) and (2).

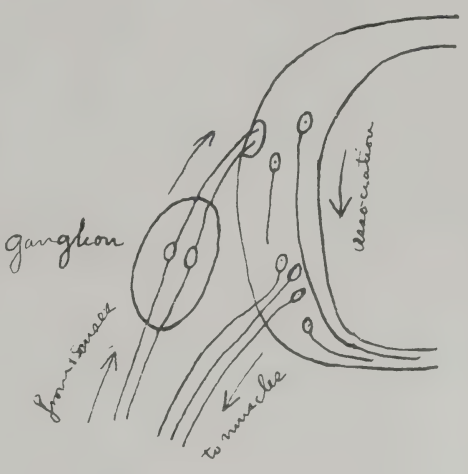


FIG. 47.
The three kinds of cells forming the nervous system. After His: Address upon the development of the brain. Fig. 2.

Summary:—1. The means of taking in the stimuli surrounding our bodies is the sensory system of bipolar cells situated either within the end organ of sense or in groups (ganglia) at various distances between the sense organs and the cerebro-spinal system. The uniform plan of the sensory cells is one fiber growing out to the surface of the body to receive thro the sense organ the stimulus, and the other fiber growing into the cord or brain to conduct the stimulus therein.

2. The cerebro-spinal nervous matter consists of (a) intaking fibers of the outlying sensory cells. (b) motor cells with their outgoing fibers, and (c) a mass of cells serving to connect together the different sensory stimuli and to connect these associated stimuli with the outgoing motor cells, these different grades of interpolated cells having all the general functions of association.

3. The embryological evidence confirms this simplified plan of the functionally different cells, viz.: (a) sensory cells outside the cord and brain tube, (b) motor cells going out of the tube, and (c) association cells within the tube.

4. The specialized function of the small brain is to make the important associations for our complicated motor reactions and expressions.

5. The specialized function of the large brain is to make associations of the stimuli from the surrounding world so that thinking and feeling result, whereby reactions are made with more prevision for our welfare.

6. The wonderful advance of the last dozen years in our knowledge of our marvellous brain cells has been in disclosing an inconceivable possibility for association, which is the great psychological basis of our mental life. So that with an ever increasing wonder on seeing real pictures and details of this most intimate and beautiful mechanism, its earnest students can share some of the satisfying and yet stimulating strength of Flechsig when he concludes the preface of his epoch-making work,—"More and more have I the conviction that the brain covers fully and completely the facts of the mental life as their organ, and that we are in a situation to develop the conditions of this dependence with the same exactness as in the other phenomena of nature accessible to our knowledge."

Harlow Gale.

ON THE PSYCHOLOGY OF ADVERTISING.

Desiring to make a psychological study in the phenomena of advertising we sent out in the fall of 1895 the following preliminary question blank to about two hundred business firms, mostly in the cities of St. Paul and Minneapolis.

UNIVERSITY OF MINNESOTA.

Question Blank No. 3 in Experimental Psychology. For the Study of Advertising.

At the University of Minnesota we are making a psychological investigation of advertisements. It is an entirely new field for psychological work and one of great and increasing importance. It is our aim to find the mental processes which go on in the minds of the customers from the time they see the advertisement until they have purchased the article advertised. To get down to the bottom of our subject and make our work successful, we need the aid of experienced advertisers, and to that end we have sent out this circular with the following questions and will be greatly indebted to you if you will send us your answers to them. Please return answers to H. Gale, University of Minnesota.

Advertisements seem to have two aims, viz: 1. To attract attention. 2. To induce to buy.

If you have any corrections to make with this they will be gladly received.

We have classified the chief ways of advertising into four groups, viz:

1. Magazines and periodicals.
2. Newspapers and handbills or posters.
3. Show-windows.
4. Painted signs and placards.

Do you know of any other ways of advertising?

What are the best ways you have found in your experience for attracting attention under these four ways of advertising?

Please name them in the order of their importance from best to poorest.

Give your reasons why each way of attracting attention does attract attention.

What are the best ways you have found in your experience for inducing people to buy? (e. g., constant reiteration of firm or article, odd figure prices, leaders, testimonials, prizes, use of superlatives, argument, plain statement, etc.)

Please name them in the order of their importance, from best to poorest.

Give your reasons why each way of inducing people to buy does induce them to buy?

Tho only some twenty were answered and returned, yet they gave us many valuable corrections and additions from

their experience, for which we desire thus tardily to express our most appreciative thanks.* In personal interviews too with large advertisers we have largely profited.

The means of advertising should thus be enlarged as follows:—newspapers, magazines and periodicals, trade journals, circulars, handbills, posters, bulletin boards, signs and placards outside or inside stores and in street cars, show windows; size, form, decoration, color, and illumination of store; printed or stamped novelties like lead pencils, paper weights, note and pocket books, calendars, clocks, pocket knives, rulers, tapes, toys, puzzles; registers, directories, theatre programs, coupon system; street banners, delivery wagons, tricycles, electric carriages, floats; samples, catalogues, agents, and traveling men. Of course it is hard to draw the line at what is advertising. Many business men are conspicuous in clubs, churches, athletics, society, dress themselves or their wives loudly, drive tandem or four-in-hand,—all more or less consciously for the publicity these means afford. But the direct kinds of advertising might be characterized as any intentional means used to associate in the buyer's mind any article or group of articles of commerce with a particular make of that article or with a particular seller of it.

In the midst of the intense competition of this flood of advertising material the first question is as to the comparative attention-power of the different means. It is a problem in involuntary attention. For if one deliberately and voluntarily seeks or reads one advertisement over others then the attention problem is pushed farther back as to the reasons which made the seeker want to find that particular advertisement. As the chief means of advertising articles, and not so much the seller, is the popular magazines, we have made special experimental tests as to the attention value of cuts as against text or reading matter, of the relevancy of each as against irrelevancy, and as to the effect of repetition on each of these four components. Any differences in the sexes in regard to these five components was also kept in view. These experiments were made during the college year of 1896-7 by students of my advanced Psychology work. The twelve observers or reagents were the Misses Susanne T. Donaldson, Mary Evans,

*We are under special obligations and thanks for the interest and help of Messrs. W. J. Halliday, M. L. Rothschild, H. H. S. Rowell, Noyes Bros. & Cutler, J. W. Thomas & Co., W. M. Regan, E. G. Walton, and the advertising specialists, Arthur Plato, N. C. Fowler, Jr., Geo. Kissam & Co., and F. W. Decker.

Mary Hooker, and Lulu McGregor; Messrs. C. W. F. Carlson, H. R. Brill, Jr., H. L. Dixon, H. Gale, J. E. Holmes, G. R. Horton, F. Mills, and A. A. Norton. To Mr. E. A. Farmer belongs special credit for much preliminary work, and Messrs. Holmes and Horton heroically carried out the compilation and tabulation of the more than six thousand experimental trials. At the trials each reagent sat in our small dark room, furnished with a table, chair, and an electric light of ½ candle power, which, owing to its very small size, would flash practically instantaneously. Upon the table, at a distance of about two feet from the observer, was a vertical frame upon which the matter to be tested was fastened. The electric lamp was placed directly before this, and by means of a reflector the light was covered from the observer's eyes and concentrated upon the printed matter. With the reagent thus in position, the pages for observation were fixed in position by the operator in an order unknown to the observer, and the light was flashed by the operator. The aim was to obtain as nearly as possible in an experiment the conditions of rapidly turning the leaves of a magazine to see what would catch one's attention. Five consecutive trials were given to each sheet. Tho the aim was to make the flash so short that the observer could only see one thing on each sheet, if the observer saw more than one word, group of words, or cut, he was to report the matter first seen.

SERIES A. COMPLETE MAGAZINE ADVERTISING PAGES.

The first series of experiments was made upon complete pages taken from the advertising portions of three popular monthly magazines; fifty-eight pages being from the *Century* and *Harpers* each, and 48 from the *Cosmopolitan*. This total number of 162 insured all combinations of our four methods of advertising and could be taken as fair representatives of magazine advertising. Eight students were used as observers, four young women and four men. Each reagent was given five trials on every page examined at a sitting, which usually extended over about twelve pages, thus making for each reagent about sixty trials a day. In this way a total of 3,155 trials were made in this series. The operator recorded the magazine, page, and the description of what the observer saw. The following is a sample of one such record for the five trials.

Harpers, p. 70.

1. "The gun goes off."
2. "Waverly."
3. Cut of a man shooting a gun.
4. "Blue Label."
5. "Scott's Emulsion."

These descriptions were first separated into words and cuts, and then each of those groups was divided into two classes of relevancy and irrelevancy. Relevant words and cuts refer in general or in particular directly to the article or matter advertised, as a cut of a collar for a Shirt & Collar Co., and the large word "Cameras" for a dealer in photographic materials. Irrelevant cuts and words have no such association, as a cut of an attractive girl in an advertisement of varnishes, and the large words "Common Sense" for a maker of chairs. There are of course all degrees of direct or remote associations, so that sometimes there is much doubt as to the relevancy or irrelevancy of cuts or text matter. There is also much question as to how trade marks and proper names should be classed. Originally they are like the Christian names given to infants, without any associations with that particular child; so that the name of a new soap or typewriter is at first irrelevant. But in our trials many of the long-advertised or used soaps or typewriters were inseparably associated with their special names. In the accompanying Table I are given the totals of each observer for each of the five trials, the complete totals of each observer, the totals of the eight observers for each trial, and the final totals of the sexes separately and both together in all the trials.

rw. = relevant words; rc. = relevant cuts.

iw. = irrelevant words; ic. = irrelevant cuts.

o. = nothing new seen beyond what had been seen at previous trials.

SERIES B. SPECIAL SHEETS OF MAGAZINE ADVERTISEMENTS.

In order to offer a more nearly equal proportion of relevant and irrelevant words and cuts a special set of twelve sheets was made up of advertisements cut from similar magazine pages. The sheets were composed as follows:

1. Two relevant and two irrelevant sets of words, each a quarter page.

2. Small advertisements of a few words or lines, both relevant and irrelevant cuts and words appearing.

3. Two quarter page sets of words, one relevant and one irrelevant; two quarter page cuts, one relevant and one irrelevant.

4. A mixture like p. 2.

5. Two relevant and two irrelevant quarter page cuts.

6. Bicycle ads., cuts and words.

7. Similar to p. 5.

8. Two relevant and two irrelevant cuts of different shapes.

9. Four irrelevant quarter page cuts.

10. Two relevant and two irrelevant quarter page sets of words.

11. Mixture like pp. 2 and 4.

12. Two quarter page cuts, one relevant and one irrelevant; two quarter page sets of words, one relevant and one irrelevant.

The numbers of the four kinds of ads. in these "Special Sheets" as compared with those counted in all the advertising pages in the back of two numbers of the magazines is as follows:

	rw.	iw.	rc.	ic.
"Special Sheets"	35	10	25	20
Harpers Nov. '95	222	22	109	60
Century Feb. '96	189	46	120	49

In this series ten observers were used, two of the men and all of the young women of the former series. The totals for this series as for the previous series are given in Table II.

To further test the attention value of our four components we selected the records of pp. 1, 3, 5, and 10 of these "Special Sheets" and combined them into the accompanying Table III. These pages were selected because their chief kinds of advertising gave four chances to each of the four forms of rw., iw., rc., and ic. But unfortunately this table even does not give a pure case of the equal chances of these four components for our attention, because of the difficulty or impossibility of getting complete ads. with only text or only cuts. So that altho pp. 1 and 10 were scheduled as each consisting of two relevant and two irrelevant text or word ads., yet there were also three cuts on the two pages; and altho they had seemed a priori of so subordinate value as to be neglectable, it turned out on trial that these cuts were frequently seen by the observers in

preference to the reading matter. The same occurred vice versa with p. 5, where the cuts were supposed to be predominant. But a comparison with Table II shows that with these at least nearer equal chances the rw. remain the same, iw. have increased, rc. and ic. have decreased. A graphic comparison of the percentage totals of Tables I, II, and III, is given in Fig. 1.

The foregoing three tables are the results with five trials at each page, corresponding thus to some degree of acquaintance and recognition of the advertising pages of the magazine. But they do not give the comparative attention value of the cuts and text, relevancy and irrelevancy at the first sight alone. But by selecting from the previous three tables only the first trials we have this initial attention value by itself in the following:

FIG. 1.

TOTAL PERCENTS ON TABLE.

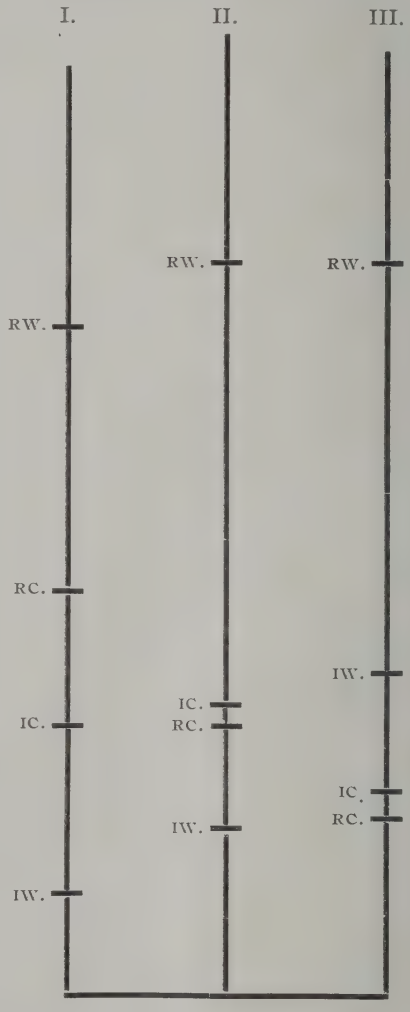


TABLE IV.

First exposures or trials alone.

MALES.	RW.		IW.		RC.		IC.	
From Table I....	109	36 %	18	6 %	98	32 %	79	26 %
" " II..	136	36 "	67	18 "	97	25 "	79	21 "
Both I and II..	245	36 "	85	12 "	195	28 "	158	23 "
From Table III.	27	23 "	45	38 "	22	18 "	25	21 "
FEMALES.								
From Table I....	113	34 %	9	3 %	105	32 %	103	31 %
" " II..	90	37 "	25	10 "	72	30 "	53	22 "
Both I and II..	203	36 "	34	6 "	117	31 "	156	27 "
From Table III.	27	34 "	18	22 "	18	22 "	17	21 "

A comparison of this Table IV with Tables I and II shows rw. still holding first place, tho with much decreased value. Then follow in order for both sexes rc., ic., and iw., tho both classes of cuts have increased in value and iw. have slightly decreased. In the first trials from Table III, however, occurs the only exception to rw. occupying the first place. Here for some inexplicable reason the highest attention value for the males is with iw., altho rw. still holds first with the females. In both sexes the other three elements are nearly equal, and the query might arise whether, with these first trials alone and with as nearly equal chances for the four elements, these results did not show that the attention value was after all only a matter of chance.

One difficulty we had experienced however in all the results so far was that of getting complete ads. in which there was one of four components alone. Even in the four sheets selected from Series B to form Table III, some apparently insignificant words were really seen occasionally in preference to the predominant cut. Thus there had not yet been offered a really equal chance for our four components. To make one more test then we got up in the fall of 1899 thirteen sheets of advertising matter by clipping out single relevant or irrelevant words or groups of words and relevant or irrelevant cuts, thus making up thirty-two chances each for rw., iw., rc., and ic. Eight University Senior men and five young women, a different set from the previous ones, have acted as observers with the same apparatus, and made up a total of over 1,200 trials.* The result of each man's ten trials and each woman's five trials at each sheet, and also each observer's first trials alone, are given in the following.

*Special acknowledgements are due, not merely to their patience as observers and operators by turn, but to their reckoning out of the results of the several series during 1899-1900, to Messrs. Geo. E. Cole, E. R. Dibble, Frank Force, C. G. Ireys, Horace Klein, Horace Lowry, C. S. Pillsbury, and J. S. Pillsbury, Jr. We are also under obligations for their kindness in acting as observers to the Misses Bradford, Camp, Mattison, Sawyer, and Thomas.

TABLE V.

SERIES C. TEST SHEETS WITH EXACTLY EQUAL NUMBER OF RW, IW, RC AND IC.

Observers	1st Trial	Total Trials	1st Trial	Total Trials	1st Trial	Total Trials	1st Trial	Total Trials
Male.	RW.		IW.		RC.		IC.	
Cole	1	17	4	35	4	40	4	38
Dibble	1	10	1	42	6	55	5	23
Force	0	18	5	41	4	36	4	35
Ireys	1	18	2	22	3	22	7	68
Klein	3	29	4	27	3	33	3	41
Lowry	3	30	2	20	5	41	3	39
Pillsbury, C	1	30	6	35	1	27	5	38
Pillsbury, J	1	24	5	38	3	31	4	37
Totals	11	176	29	240	29	285	35	319
Percentage	10.5	17.2	28.	23.5	28.	28.	33.6	31.2
Female.								
Bradford	2	5	4	13	2	15	5	32
Camp	3	13	1	10	1	7	8	35
Mattison	2	6	2	4	3	16	6	39
Sawyer	2	9	4	10	2	16	5	32
Thomas	2	10	1	13	6	20	4	22
Totals	11	43	12	50	14	72	28	160
Percentage	17.	13.	18.4	15.	21.5	22.	43.	49.

The results of these new trials were startling in comparison with the old ones, for the attention order is almost reversed. The relevant words have fallen from first to last place, irrelevant words and relevant cuts do not vary much from the probable number of chances, while the highest value is taken by irrelevant cuts. How far this very different order is due to a different set of observers is of course uncertain, but considering the number of observers, the comparatively unimportant individual variations from the average, and both sets of observers being of the same age and social class, it seems more probable that the opposing results are due to the differing material. In favor of the last set of trials in Table V is the fact of there being an equal number of chances offered for the four components. But as against them on the other hand the results were complicated by the varying sizes of the words and cuts, a few of the cuts being unfortunately so much larger than the other cuts and words on the same page that they were seen by almost all the observers at each trial, and specially by the fact of the unnatural separation of words and cuts as they are used in a complete ad.; so that, for example, some cuts taken from ads. where they were used irrelevantly and so classified separately as irrelevant could be just as well used in another ad. relevantly.

Therefore to avoid this last uncertainty as to the relevancy of a cut standing alone another Series D of six sheets was prepared in which each article advertised was represented by both words and a cut, all the words and cuts being equally divided as to their relevancy or irrelevancy to the article advertised. The result of five exposures of each sheet as follows.

TABLE VI.

SERIES D. FOUR TO SIX ADS. ON A PAGE; EACH AD. REPRESENTED BY BOTH WORDS AND A CUT; EQUAL NUMBER OF THE FOUR CLASSES.

Observers.	rw.	iw.	rc.	ic.
Cole	2	2	16	10
Dibble	1	3	16	10
Force	3	4	11	12
Ireys	6	3	10	11
Klein	10	3	9	8
Lowry	2	4	10	14
Pillsbury, C.	1	5	11	13
Pillsbury, J.	8	3	9	10
Totals	33	27	92	88
Percentage	13.7	11.2	38.3	36.6

The outcome of this series was that rc. increased in their attention value until they slightly exceeded the ic.

But one difficulty was found with this series in that with several ads. of words and cuts on a page, some one cut or group of words was so much larger than the others on the page that it was seen almost exclusively. To obviate this disturbing element of varying size another series E was prepared, consisting of ten sheets with only a single article advertised on each sheet, the ad. being made up of combinations of two from our four elements. As two irrelevant words or cuts could not be put together to make up an ad. (for then of course one would not know what article was advertised), the total number of our four elements used in this series was unequal and consisted of six each of rw. and rc. but only four each of iw. and ic. The corrected percentages were therefore made by adding one-third to the actual observations of iw. and ic. As this was the last series of trials in this section of our work on the attention value of words and cuts, relevancy and irrelevancy, the individual results on each pair of these four elements, together with the corrected percentage totals are given in Table VII.

TABLE VII.

SERIES E. ONE AD. ON A PAGE; EACH AD. REPRESENTED BY TWO ELEMENTS; CORRECTED EQUAL NUMBER OF THE FOUR CLASSES.

Observer.	Cole.	Dibble.	Force.	Ireys.	Klein.	Lowry.	C. Pillsbury.	J. Pillsbury.	Totals.
Sheet 1: Rc. Quaker Oats Man..	1	3	6	4	1	1	3	1	20
Rw. "Quaker Oats".....	9	7	4	6	9	9	7	9	60
Sheet 2: Iw. "Turn over in your mind".....	8	5	4	7	6	10	3	8	51
Rc. Cut of a camera.....	2	5	6	3	4	0	7	2	29
Sheet 3: Rw. Cuticura Resolvant".....	2	4	3	5	8	10	3	6	41
Iw. "Bad complexions"	8	6	7	5	2	0	7	4	39
Sheet 4: Iw. "Stands alone".....	3	5	6	7	4	6	4	5	40
Rc. Of hair brush.....	7	5	4	3	6	4	6	5	40
Sheet 5: Rw. "Pianos".....	7	6	5	9	8	10	5	8	58
Rc. Of piano.....	3	4	5	1	2	0	5	2	22
Sheet 6: Iw. "Weber".....	5	6	5	4	8	8	6	2	44
Rw. "Boats".....	5	4	5	6	2	2	4	8	36
Sheet 7: Rw: "Ceilings".....									
Ic: Of a dog walking on hoops.....	5	6	4	3	2	7	6	6	39
Sheet 8: Ic. Two dogs lying down.....	5	4	6	7	8	3	4	4	41
Rw. "Columbia," in characteristic design..	5	7	6	3	2	5	3	2	33
Sheet 9: Ic. Of a woman's head.	5	3	4	7	8	5	7	8	47
Rc. Of a moccasin.....	6	5	7	7	4	6	5	4	44
Sheet 10: Ic. A man's head.....	4	5	3	3	6	4	5	6	36
Rc. Filing cabinet.....	5	7	8	7	8	7	8	8	58
	5	3	2	3	2	3	2	2	22
PERCENTAGES.									
Rc.....	19.2	21.7	22.4	14.7	18.4	10.4	24.5	16.1	18.4
Rw.....	28.7	26.1	21.6	31.0	32.5	37.4	28.1	40.2	30.7
Ic.....	24.3	27.0	31.0	27.6	25.7	24.4	23.7	22.3	25.6
Iw.....	27.8	25.2	25.0	26.7	23.4	27.8	23.7	21.4	25.3

The individual trials thus show, e. g., that the words "Quaker Oats" were seen about three times as often as the familiar cut of the Quaker, both being of the same size and placed side by side; or that the irrelevant catch phrase "Stands alone!" was about equally attractive to an equally sized cut of a hair brush. But the main interest in this series is that the totals come back finally to a similarity to our older sets of trials (Series A and B), in that rw. again takes the first place. Both rc. and ic. come out just with their 25% of chance, so that the advantage of rw. has been gained at the loss of rc. Tho the 30% value of rw. is not as high as in the old trials,

yet, as this is the fairest test we have made, we are quite inclined to consider our later series with experimentally made-up advertising matter as confirmatory at least of rw. having the highest attention power.

This judgment of the greater value of relevant text matter is increased when we come to arrange our statistics to show the effects of repetition. From the complete Tables, I, II, and III, a table was prepared showing the proportional value of our four components for each of the five successive exposures or trials. The object of having these repeated trials was that it corresponded somewhat experimentally with the fact of our seeing an ad. usually more than once, either in the same or different magazines. The results of the effects of five repetitions is given in Table VIII and shown graphically in the following Fig. 2.

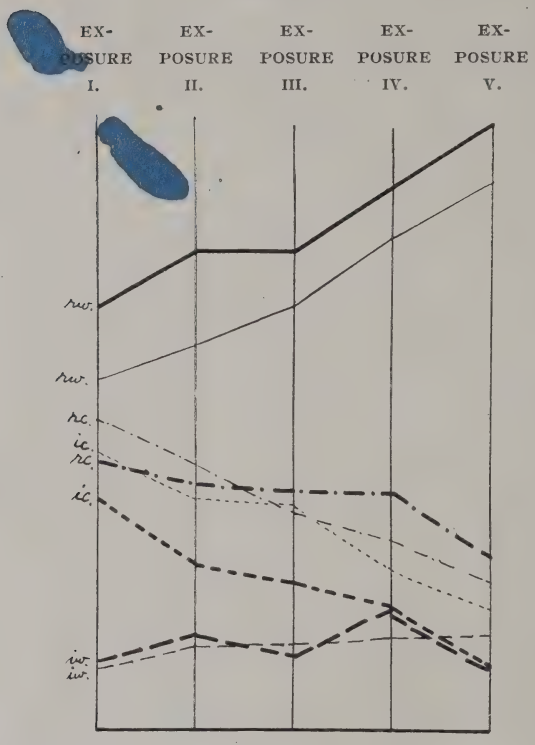
TABLE VIII.

EFFECTS OF REPETITION, IN PERCENTAGE.

	EXPOSURE I.				EXPOSURE II.				EXPOSURE III.			
	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.
Tables I and II, 4 Males.....	42.6	6.6	23.7	23.1	48.3	9.	25.	17.	48.	7.5	24.5	15.
Tables I and II, 4 Females.....	35.6	6.	31.	27.3	39.	8.6	26.9	23.5	43.	8.4	22.	23.
Table III, Males.	22.6	37.7	18.5	21.	40.8	27.	18.2	13.9	57.	20.5	10.2	12.1
Table III, Females.....	33.7	22.5	22.5	21.2	45.7	26.5	13.2	14.4	43.3	22.3	13.1	21.

	EXPOSURE IV.				EXPOSURE V.			
	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.
Tables I and II, 4 Males.....	55.	12.	24.	12.5	61.5	7.	17.4	6.7
Tables I and II, 4 Females.....	50.	9.6	19.	16.5	55.8	9.7	15.	12.5
Table III, Males.	64.1	17.2	6.8	13.7	75.7	12.1	4.6	7.4
Table III, Females.....	64.1	19.2	9.	7.7	71.	14.1	6.4	7.7

FIG. 2.



Heavy lines—Males.
Light lines—Females.

Here for both sexes there is on the whole a constant and decided increase in the value of relevant words; i. e., tho they start highest, one was more and more inclined to see relevant words with increasing familiarity with an ad. With both classes of cuts, however, there is an opposite tendency to see them less and less. The irrelevant words, which start with the lowest value, keep substantially on that plane.*

As to any differences between the sexes the comparison in Tables IX and X shows that in spite of the opposing results otherwise in the older series A and B as against series C, yet the men were in both sets proportionately more caught by words. Similarly on the question of relevancy and irrelevancy the female attention was more susceptible to irrelevancy, as it was to cuts, than the masculine attention.

*Even in our last experiments in Table V there is apparently an increase in relevant words with repetition, even they both start and end there with the lowest value.

TABLE IX.

COMPARISON OF TEXTS AND CUTS BETWEEN THE SEXES.

BASED ON.		WORDS.	CUTS.
Men	Tables I and II	30.9 per cent.	19. per cent.
	Table V	20.3 "	30. "
Women	Tables I and II	26.8 "	22.8 "
	Table V	17.7 "	32.2 "

TABLE X.

COMPARISON OF RELEVANCY AND IRRELEVANCY BETWEEN THE SEXES.

BASED ON.		RELEVANCY.	IRRELEVANCY.
Men	Tables I and II	37.8 per cent.	12.1 per cent.
	Table V	22.6 "	27.3 "
Women	Tables I and II	34.1 "	15.5 "
	Table V	17.5 "	32.0 "

ATTENTION VALUE OF DIFFERENT PARTS OF A PAGE.

We then wished to test the attention value of different parts of a page, and also the relation of attention to different sizes of type. The following four words were first taken in this size type and each word was pasted on a sheet in each of the four positions as follows, thus making four sheets:

The results of ten electric light exposures of each sheet to each observer are given as follows in

TABLE XI.

NAMES OF OBSERVERS.	No. of 1st place seen.	No. of 2nd place seen.	No. of 3rd place seen.	No. of 4th place seen.	No. of Battles seen.	No. of Soaps seen.	No. of Pianos seen.	No. of Bicycles seen.	Order of Places Seen.
Cole	2	20	15	3	9	12	10	9	2nd, 3rd, 4th, 1st.
Dibble	3	18	15	4	11	6	15	8	2nd, 3rd, 4th, 1st.
Force	2	21	15	2	10	10	13	7	2nd, 3rd, 1st, 4th.
Ireys	10	22	6	2	7	13	8	12	2nd, 1st, 3rd, 4th.
Klein	10	23	7	0	11	13	8	7	2nd, 1st, 3rd, 4th.
Lowry	2	26	11	1	10	10	11	9	2nd, 3rd, 1st, 4th.
Pillsbury, C.	8	16	12	4	11	11	7	11	2nd, 3rd, 1st, 4th.
Pillsbury, J.	1	20	18	1	13	7	11	9	2nd, 3rd, 1st, 4th.
Totals	38	166	99	17	82	82	83	73	
Percentages	11.8	51.8	20.9	5.3					

SERIES F. HORIZONTAL QUARTERS OF A PAGE.

Position 1. **Bicycle**

Position 2. **Piano**

Position 3. **Battle**

Position 4. **Soap**

The table shows that the four words were seen practically the same number of times, and that therefore they were presumably near enough in size and interest to be used in the subsequent experiments, instead of using one and the same word in all positions and sizes. But to our surprise the table showed that the quarter above the horizontal middle (position 2) was seen by every observer most often, the 3d position decidedly next on the average, the first position next, and the bottom position least of all.

To further test this disclosed attention advantage of the second quarter on the page another series G was prepared with five to eight words on a page and with different sized type as follows:

SERIES G.

Sheet No. 1. With 5 mixed words, all this size and kind of type, **Bicycle**

Sheet No. 2. With 6 mixed words, all this size and kind of type, **Bicycle**

Sheet No. 3. With 7 mixed words, all this size and kind of type, **Bicycle**

Sheet No. 4. With 8 mixed words, all this size and kind of type, **Bicycle**

TABLE XII.

SERIES G. VERTICAL QUARTERS OF PAGE, WITH VARYING NUMBERS OF WORDS AND SIZE OF TYPE.

NAMES.	POSITION.			
	FIRST.	SECOND.	THIRD.	FOURTH.
Cole	9	21	10	0
Dibble	5	16	18	1
Force	9	19	11	1
Ireys	10	21	9	0
Klein	13	15	10	2
Lowry	21	18	1	0
C. Pillsbury	1	22	17	0
J. Pillsbury	0	28	12	0
Totals	68	160	88	4
Percentages	21.2	50.	27.5	1.2

The results of these observations, while showing not quite the individual uniformity of the previous series, yet give an average of the eight observers for the same order of the four positions on the page,—the second quarter being indeed still higher. (The pages were divided into quarters as nearly equal as possible, with one or two words in a quarter.)

These experiments on the value of the position and size on the page were finally further varied in that two vertical halves of the page were made, with four horizontal quarters, four sizes of type and two kinds of type; the following being a sample, but condensed by the words being nearer together than in the orginal sheets.

Sample of Series H.

Soap Piano

Bicycle *Battle*

Piano Soap

Battle *Bicycle*

Each word in the two halves was changed to occupy each of the four quarter positions, and thus four sheets were made giving equal chances to the five elements we wished to test, viz., right and left side of page, the horizontal quarters of the

page, size of type, and plain as against fancy type (latter being the slanting type). These observations were made in diffused daylight thro exposing the sheets at a distance of two feet by means of a large photographic shutter with an aperture of 2 inches. The aperture was fastened on a level with the middle of the sheet, and the distance was sufficient to bring the whole sheet within the range of readable vision, while a very slight eye-movement could bring any part of the sheet within the point of clearest vision. The results of 10 trials by each of the 10 male and 5 female observers are given in

TABLE XIII.

MALES—10.	Left.	Right.	POSITION.				Fancy.	Plain.	SIZE TYPE.			
			1	2	3	4			1	2	3	4
Cole	16	24	5	18	8	9	27	13	3	8	13	16
Dibble	21	19	.....	12	28	.....	19	21	10	7	11	12
Emerson	22	18	8	12	14	6	17	23	2	7	9	22
Force	23	17	4	1	32	3	21	19	5	10	13	12
Gale	26	14	8	19	13	.....	25	15	.....	9	12	19
Ireys	25	15	1	20	18	1	16	24	3	10	9	18
Klein	22	18	1	6	31	2	28	12	9	11	8	12
Lowry	27	13	10	23	5	2	18	22	3	9	14	14
Pillsbury, C	18	22	2	14	17	7	23	17	.....	6	14	20
Pillsbury, J	13	27	3	12	15	10	25	15	.....	4	8	28
Totals	213	187	42	137	181	40	219	181	35	81	111	173
Percentages	53.2	46.8	10.5	34.2	45.2	10.	54.7	45.3	8.7	20.2	27.7	43.
FEMALES—6.												
Camp	27	13	5	10	12	13	34	6	1	3	8	28
Fowle	14	26	5	34	1	.....	22	18	9	6	12	13
Harrington	20	20	12	17	8	3	20	20	5	3	11	21
Harris	27	13	3	24	12	1	18	22	4	10	14	12
Lenox	8	32	1	13	21	5	19	21	6	7	9	18
McDonald	27	13	25	12	2	1	20	20	3	9	12	16
Totals	123	117	51	110	56	23	133	107	28	38	66	108
Percentages	51.3	48.7	21.2	45.8	23.3	9.5	55.4	44.5	11.6	15.8	27.5	45.

SERIES H. (SEE SAMPLE ABOVE).

This table gives the following conclusions: (1) Quite a decided advantage on the average for the left half of the page; presumably from our habit of reading from left to right. How far this advantage of the left side would be interfered with by the sheets being in book form with an outside and an inside half is uncertain.

(2) As to an advantage among the horizontal quarters the men showed a preference this time for the third quarter (below the middle), tho the young women showed a more decided preference for the quarter above the middle.

(3) There is on the average a regular gradation of attention with the size of type, within the limits used above. In a series tried before this one, the results of which were not used on account of a mistake in the regular arrangement of the words and sizes, this gradated dependence of attention on size was very clearly shown.*

(4) The average higher attention value for both sexes of the fancy type over the plain is probably due to the larger size of the fancy. For tho they are classed commercially as the same size the fancy type runs from a half to three mms. higher than the corresponding size of the plain type, and this not counting the slant of the fancy.

ATTENTION VALUE OF COLORS.

Now that the use of colors is becoming more practicable in printing as they have been in painted signs and bulletin boards, we have made a special set of experiments as to the attention value of different colors. We selected the standard colors, according to Bradley's Color Chart, of red, orange, yellow, green, blue, and purple; mounted these in one inch squares, together with a black square, on a nine-inch square white cardboard; and the same colors in the form of one inch discs, together with a white one, were mounted on a similar black cardboard. Each card was momentarily illuminated by the same electric light apparatus, and was turned on a different side at each trial to have the illumination and fixation point of the eyes equally distributed. The proportion of colors thus first seen by nine male and seven female observers in 50 trials by each person at each background are as follows:

*Scripture, in his popular and ingeniously suggestive Chautauqua book "Thinking, Feeling, Doing," 1895, has illustrated this application of the connection of size and attention, as well as several other suggestions concerning advertising. See his pp. 93-99 and 248.

TABLE XIV.

ATTENTION VALUE OF COLORS.

MALES—9.	ON WHITE.						
	Black.	Red.	Orange.	Yellow.	Green.	Blue.	Purple.
Cole	22	10	9	.....	8	1	.....
Dibble	11	14	6	.....	16	3	.....
Force	14	15	4	3	9	3	2
Gale	11	22	3	.....	14	.....	.....
Ireys	12	13	17	.....	8	.....	.....
Klein	18	6	20	1	5	.....	.....
Lowry	20	2	10	.....	16	2	.....
Pillsbury, C	24	1	10	.....	6	7	2
Pillsbury, J	19	5	9	.....	5	8	4
Totals	151	88	88	4	87	24	8
Percentage	33.5	19.5	19.5	.8	19.3	5.3	1.7
FEMALES—7.							
Bradford	4	18	5	4	6	9	4
Camp	.....	19	13	.....	15	3	.....
Crocker	11	13	3	3	9	9	2
Donaldson	6	20	.....	8	4	6	6
Mattison	7	12	8	.....	14	2	7
Sawyer	8	21	.....	2	11	4	4
Thomas	7	10	9	6	7	5	6
Totals	43	113	38	23	66	38	29
Percentage	12.2	32.2	10.8	6.5	18.8	10.8	8.2

MALES—9.	ON BLACK.						
	White.	Red.	Orange.	Yellow.	Green.	Blue.	Purple.
Cole	3	20	3	12	9	3	.....
Dibble	1	12	10	.....	21	6	.....
Force	6	7	5	16	14	1	1
Gale	21	18	1	1	7	2	.....
Ireys	10	7	11	11	11	.....	.....
Klein	17	9	5	.....	19	.....	.....
Lowry	2	13	5	3	24	3	.....
Pillsbury, C	16	7	2	2	17	6	.....
Pillsbury, J	17	3	3	4	19	4	.....
Totals	93	96	45	49	141	25	1
Percentages	20.6	21.3	10.0	10.8	31.3	5.5	2.0
FEMALES—7.							
Bradford	15	8	.....	5	18	3	1
Camp	1	14	.....	13	13	4	5
Crocker	14	4	5	11	6	8	2
Donaldson	5	13	.....	10	10	6	6
Mattison	9	8	3	7	8	5	10
Sawyer	1	18	.....	8	9	7	7
Thomas	.....	13	10	8	13	.....	6
Totals	45	78	18	62	77	33	37
Percentages	12.8	22.2	5.1	17.7	22.2	9.4	10.5

Thus on a white background the contrast of black was most effective for attention with the males, with red, orange

and green all equal for second place; while with the females red was first and green second. With the colors on the black background, however, it was a great surprise to us that the most effective color proved to be green with males and was equal to red with females. It was somewhat remarkable that green had stood so high on the white background. There is some question how near white, on black, should come to green for second place; with the short illumination in our trials the yellow often appeared as white, but how much of the yellow should be credited to white we cannot determine.

It is interesting to find that, while the value of white and black together is apparently due to the strength of the stimulus by contrast, the high attention value of red with the females corresponds to its being the color most liked by females, while green is the color most disliked by both males and females, as we have found in our census of the preferences and dislikes for colors.

SUBCONSCIOUS ATTENTION AND MEMORY.

The conscious as against the subconscious or unconscious effects of advertising have been the object of some special tests, by asking our students what they remembered of several particular advertisements as to color, designs, words, mottoes and rhymes. Thus, for example, to the question "What are the letters by which a much advertised dress braid is identified?" almost every one knew what brand was meant; but out of 65 males and 36 females only about half of each gave the letters "S. H. & M." correctly, while 17 men and 4 women could not give any of the letters. Asking for the colors and designs of the ads. for Carter's Little Liver Pills, Royal and Dr. Price's Baking Powder showed an even larger proportion of incorrect memories or even no memories. To the question, "Do you remember any words on mottoes used with a much advertised hook and eye?"; nearly half of both sexes did not recall "See that hump." But owing to the great variety of mottoes and rhymes used with Sapolio almost every one could recall one at least of these. In general, the results added more evidence to our increasing knowledge of the large part of our mental life which, paradoxical as it seems—goes on unconsciously.

PROPORTION OF PEOPLE INFLUENCED BY ADVERTISING.

The question of the proportion of men and women who are influenced by advertising is of much psychological and

practical interest. We have tried to make some rough estimate of this by getting written answers from my Junior classes for the last four years to such questions as, "If you were going to buy some toilet soap what kind would you buy and why would you buy that kind?" Similarly as to a bicycle, knitting yarn, baking powder, shaving soap and grain food. Also, "If you were going to buy ready-made clothing, where would you buy and why?" and similarly as to a violin. It was explained that under the reason "why" we wanted to know whether they would buy an article from their own experience of it, from the experience or recommendation of their friends, from having seen it advertised, or whether they could give no reason. With the articles not used by their own sex, as shaving soap and ready made clothing with the young women, and knitting yarn and baking powder with the young men, it was suggested that they imagine themselves under the necessity of getting these on an errand from home or for a holiday present, and having to ask for some particular kind. But even then quite a number could not name any brand. Those articles given as due to the experience of themselves or their acquaintances were credited to the column of experience; while not only those given as consciously due to advertising were credited to the column of advertising, but also those articles where they expressly said they could give no reason were credited as being due to the unconscious effects of advertising. The articles were chosen so as to give about equal chances to experience and to advertising, tho perhaps the young women were favored a little with the chances for experience. Tho the actual classification was rather uncertain, the rough results of all these tests together on seventy-nine males and fifty-eight females was 31% due to advertising with the males and 35% with the females.

The results on the three articles for each sex in which they presumably have had the least or no actual experience in buying are put together in Table XV.

PROPORTION OF PERSONS INFLUENCED BY ADVERTISING IN ARTICLES OUTSIDE OF THEIR USUAL EXPERIENCE.

TABLE XV.

MALES—79.	Experience.	Advertising	FEMALES—58.	Experience.	Advertising
Knitting Yarn..	30	23	Shaving Soap..	16	22
Baking Powder	38	39	Men's Clothes..	28	24
Violin.....	39	33	Violin.....	23	31
Total.....	107	95	Total.....	67	77
Percentage.	53.	47.	Percentage.	46.4	53.4

The table shows that, even from those articles in which they have had little or no personal experience, about half of those answering would seek for the experience of some friend before buying these articles or go to those firms that they had found trustworthy in other articles, and would not thus be guided by advertising. This, tho, only shows their present intention; but it is doubtful whether when it came to the actual necessity of getting one of these articles, more would not be consciously or unconsciously influenced by advertising than these figures show. Then too, as our informants told us, much advertising is not for gaining new customers, but to hold their old customers by not letting them forget the continued existence of those articles or firms which they have found trustworthy by experience. We were rather surprised that these trials did not show a comparatively larger proportion for the females in favor of advertising, as professional advertisers had told us they counted more on the women than on the men.

REASONS IN ADVERTISING INDUCING PEOPLE TO BUY.

As one of several different experimental tests in reasoning we made the following trials as to the reasons which determine readers of advertisements to be moved by one ad. over another. Four articles of soaps, pianos, house-furnishings, and clothes (for men,—with a similar set of dress goods for the women) were selected, and six different ads. for each article were written, each ad. emphasizing one or two special reasons for dealing with that firm. Thus the special points of cheapness, forced sale, age, reliability, credit, prizes, testimonials, qualities, prices, home manufactures, &c., were made. As all the ads. were fictitious as to names and firms the readers of them had no associations connected with them. Thus the readers were asked to imagine themselves in a new city where they needed to go out and buy each of these articles, and from these ads. they must select the place where they would go first, then their second choice, third choice, and c. to the sixth place, which would attract them least of all. Then especially they were to give their reasons for each choice. Replies were thus gotten from seventy-two males and thirty-three females; a minority of each being University Juniors and Seniors, and a majority from their family circles or friends. The sets of ads. were not laid before our readers in any regular order, but they were asked to read thro each set carefully before they began to

make their choices. The following were the set of ads. for soaps:

SOAPS.

No. 1. Our Velvet Soap is attractive to touch, sight and odor.
Oriental Perfume & Soap. Co.

No. 2. Colonial Soap. Richard Endicott & Co. Founded in 1831.

No. 3. Soap Special Sale at "Swanson's Mammoth."
"Lilly"—6 cakes for 37 cts.
"Queen's Own"—6 cakes for 34 cts.
Omaha Packing Co.'s new "Expansion" —6 cakes for 29 cts.
Texas Cattle Co's "Get there"—6 cakes for 23 cts.
Swanson's "Pride"—6 cakes for 21 cts.
"Gold Standard" " " " 19 "
Limit of one dozen to each purchaser.

No. 4. America Soap. Government Standard. Official tests by U. S. chemist shows less than a half of one per cent of impurities. Eagle Soap Co.

No. 5. Free. A durable toy balloon given away for three days with each purchase of four cakes of Universal Soap.

No. 6. Patronize Home manufactures. Flour City soap at their home store.

Table XVI gives the ads. chosen for first place, second place, &c. to last choice, with the reasons given for choosing each ad., and the number of males and females choosing each ad. and giving each reason. Thus the No. 2 ad. of Colonial soap was chosen most by both sexes as the best kind to buy or the best place to go, judging from this ad. alone in comparison with others. Of the 22 males and 15 females choosing this ad. they gave various reasons for the choice. Thus 18 males and 6 females gave the age of the firm as their reasons, 3 M. that it was a simple ad., 4 F. that it was reliable, and 5 F. could not give their reason any nearer than that it was a "good ad." But every ad. except No. 5 got some choices for the first place to go to; and sometimes the same reasons were given for choosing different ads.

For second choice ad. No. 4 was selected most; as it was also for third choice by the M., tho the third choice of the F. fell on No. 6. Both sexes agreed on No. 6 for the fourth place to go to, tho the men were equally in favor of No 1. No. 3 was taken for next to the last place; and there was a very decided vote that No. 5 would be the last place to try.

As various reasons were given for choosing the same ad., and the same reason for different ads., all the main reasons given or each choice have been summarized below each choice. There it is seen that the age of the firm is the reason most

TABLE XVI. Soaps--Choices and Reasons for. Total of 72 Males and 33 Females.

First Choice	M.	F.	Second Choice	M.	F.	Third Choice	M.	F.

Summary of Main Reasons for Each Choice of Pianos.

Reason.	1st Choi. M.	1st Choi. F.	2d Choice M.	2d Choice F.	3d Choice M.	3d Choice F.	4th Choi. M.	4th Choi. F.	5th Choi. M.	5th Choi. F.	6th Choi. M.	6th Choi. F.
Age,	9	4	8	4	10	3	5	1	5			
Reliability,	9	6	8	2	4	1	4	7		2		
Recommendations	16	7	13	6	14	9	9	3	6	3		
Prizes,	7	2	13	6	18	5	9	5	6			
Royal approval	7	2	10	3	8	2	10	6	6	12		
Qualities,	5	4	9	4	5	1	10		5	3		
Good ad.,	4	3	3	2		8	3	4		4		
Poor ad.,							3		22	3	4	2
Fake,							1				19	6
Cheap,	8	2	2	1	1	5	5	3	12	4	20	29

TABLE XVI. Soaps--Choices and Reasons for. Total of 72 Males and 33 Females.

First Choice	M.	F.
Ad.		
No. 2–Age.	18	6
Simple.	3	
Good ad.		5
Reliable.		4
Purity.	1	
No. 4–Gov't app.	11	4
Purity,	7	6
Best offered,	1	
No reason,	1	
No. 3–Cheap,	10	2
Price stated,	2	1
No. 6–Home Ind.,	7	3
Reasonable,	1	
Attractive,	1	
No. 1–Attractive,	4	1
Name,	2	
Age,		1
Quality,		1

Second Choice	M.	F.
No. 4–Purity,	12	8
Gov't app.,	8	3
No brag,		1
No reason,		1
No. 1–Attractive,	6	
Qualities,	5	2
Plain ad,		4
Name,		2
No brag,	1	
No reason,	1	
No. 2–Age,	11	4
Facts stated		2
Personal,		1
Attractive,	1	
Reliable,	1	
No. 6–Home Ind.,	13	2
Good ad.,		1
No. 3–Price stated,	7	
Reasonable,		2
Cheap,	1	
Variety,	1	
No. 5–Balloon,		1
No reason,	1	

Third Choice	M.	F.
No. 4–Gov't app.,	11	1
Purity,	7	3
No brag,		1
No. 6–Home made,	14	7
Honest,		1
Name,		1
Trial,	1	
Good Thing,	1	
No reason,		1
No. 2–Age,	14	2
Good ad.,		2
Reliable,		2
No brag,	1	
No. 1–Good ad.,	10	
Attractive,		5
Name,	1	
Toilet soap,	1	
No Good,	1	
No. 3–Cheap,	4	
Prices,		5
Good ad.,	1	
Variety,	1	
No reason,		1
No. 5–Balloon,	1	1
No reason,		1

Fourth Choice	M.	F.
No. 6–Home made,	13	10
To the point	1	
No good,		2
No reason,	2	
No. 1–Good name,	6	
Qualities,	3	4
Good ad.,	4	1
Firm,		1
Dislike,		1
Variety,	1	
No reason,	2	1
No. 3–Cheap,	10	3
Good ad.,	1	1
Reliable,		1
No reason,	1	1
No. 2–Age,	9	2
Name,	1	
Good ad.,	1	
No reason,	1	
No. 4–Gov't test,	2	2
Purity,	2	
Honesty,	2	
Fake,		2
No. 5–Prize,	5	2
Simplicity,	1	

Fifth Choice	M.	F.
No. 3–Cheap,	7	11
Price,	7	
Variety,	1	
No good,	3	1
Chance,	1	
No reason,	3	1
No. 5–Prize,	8	1
Fake,	3	2
Cheap,		1
Good goods,	1	
Fair ad.,	1	
No reason,	1	
No. 1–Good ad.,		3
Fake,	2	4
Plainness,	2	
High price,	2	
Attractive,	2	
Order,	1	
Style,	1	
No reason	4	2
No. 6–Home made,	9	1
No good,	2	1
No reason,	1	2
No. 2–Age,	1	2
Reliable,		1
Plain ad.,	1	
No reason,	2	
No. 4–Purity,	1	1
Truth,	1	

Sixth Choice	M.	F.
No. 5–Prize,	32	6
Cheap,	6	5
No good,	7	
Fake,		11
Attractive,		1
No reason,		2
No. 3–Cheap,	7	1
Brag,		2
No good,		1
Unknown,	1	
No. 1–No good,	4	
Common,	1	
Brag,		1
Too brief,		1
No. 2–Cheap,	2	
Unattractiv'	3	
No. 4–No Good,	3	
Fake,	1	1
No. 6–Home made,	1	1
No good,	1	1

Summary of Main Reasons for Each Choice of Soaps.

Reason	1st Choic. M.	1st Choic. F.	2d Choice M.	2d Choice F.	3d Choice M.	3d Choice F.	4th Choi. M.	4th Choi. F.	5th Choi. M.	5th Choi. F.	6th Cho. M.	6th Cho. F.
Age,	18	7	11	4	14	2	9	2	1	2		
Reliable,	1	4	1	2		3				1		
Gov't approval,	11	4	8	3	12	1	2	2				
Purity,	8	6	12	8	7	3	2		1	1		
Home made,	7	3	13	2	14	7	13	10	9	1	1	
Attractive ad.,	5	6	7	8	11	8	8	1	7	3	1	
Cheap,	10	2	1		4		10	3	14	11	15	6
Price,	2	1	7			5			2		1	
Qualities,		1	5	2			3	6				
No reason,	1		2	1		3	6	2	12	5	3	2
Fake,								2	10	6	1	12
No Good,					1			4		2	17	1
Prize,				1	1	1	5	2	8	1	31	6

TABLE XVII. Pianos.--The Two Ad's Most Chosen Under Each Choice.

First Choice	M.	F.
No. 2–Age,	8	4
Reliable,	8	6
Good ad.,	1	3
Dignified,	1	
Personal,	1	
Honesty,		1
Qualities,		1
No fake,	1	
No. 4–Recommend.	16	7

Second Choice	M.	F.
No. 5–Prizes,	13	
Medals,		6
Good name,		3
Good qual.,		3
Good ad.,	2	
No reason,	1	
No. 2–Age,	8	4
Reliable,	7	1
Good ad.,	1	1

Third Choice	M.	F.
No. 4–Artists' ap.,	12	9
German,		1
Unreason'bl,	1	
Bad name,	1	
No. 5–Prizes,	18	5
Reliable,	2	
Merit,	2	1
Plain name,	1	
Good qual.,	1	
Cheap,		1

Fourth Choice	M.	F.
No. 3–Qualities,	10	
Brag,	4	1
Name,	1	1
Estab. house	2	
Unique ad.,	2	3
Recommend.	1	
Merit,		1
No. 6–Royal appr.,	10	6
High price,	1	

Fifth Choice	M.	F.
No. 6–Royal appr.,	6	8
No good,	5	
Brag,	2	
Expensive,	1	
No reason,	1	
Variety,	1	
Fake,		1
Dislike royl.,		4
No. 3–Qualities,	5	3
Poor ad.,	4	2
Good ad.,		4
No confid.,	1	
No reason,	2	1
Brag,	1	

Sixth Choice	M.	F.
No. 1–Cheap,	20	17
Fake,	8	
Bad name,		1
Fire sale,	9	
Unreliable,	1	
No. 6–No judge,	6	
Cheap,		2
Fake,	4	3
Common,	1	
Poor ad.,	2	
Brag,		1

Summary of Main Reasons for Each Choice of Pianos.

Reason.	1st Choi. M.	1st Choi. F.	2d Choice M.	2d Choice F.	3d Choice M.	3d Choice F.	4th Choi. M.	4th Choi. F.	5th Choi. M.	5th Choi. F.	6th Choi. M.	6th Choi. F.
Age,	9	4	8	4	10	3	5	1	5			
Reliability,	9	6	8	2	4	1	4	7		2		
Recommendations	16	7	13	6	14	9	9	3	6	3		
Prizes,	7	2	13	6	18	5	9	5	6			
Royal approval	7	2	10	3	8	2	10	6	6	12		
Qualities,	5	4	9	4	5	1	10		5	3		
Good ad.,	4	3	3	2		8	3	4		4		
Poor ad.,							3		22	3	4	2
Fake,							1				19	6
Cheap,	8	2	2	1	1	5	5	3	12	4	20	29

TABLE XVIII. House Furnishings.--The Two Ad's Most Chosen Under Each Choice.

First Choice.	M.	F.	Second Choice.	M.	F.	Third Choice.	M.	F.	Fourth Choice.	M.	F.	Fifth Choice.	M.	F.	Sixth Choice.	M.	F.
No. 5–Reliable,	9	1	No. 2–Good ad.,	8		No. 6–Style,	5		No. 1–Credits,	6	4	No. 3–Cheap,	16	7	No. 4–Cheap,	12	9
Age,	14	3	Moderate,	3		Novelty,	2	2	Good ad.,	5	3	Plain ad.,	1		Brag,	3	4
Good ad.,	1		Reliable,	2	3	Inviting,	4		High inter't,	2		Brag,	2		Sound,	3	
Pers'nal firm		1	Stylish,	3		Good ad.,	3		Experiment,	1		Compulsory		1	Fake,	2	1
No. 6–Refined,	6	1	Choice,	1		Impartial,		1	Brag,	1		Fake,		1	Dept. store,	2	
Up-to-date,	2	3	Novelty,		2	Oriental,	1		No reason,	1	1	Vague,		1	No reason,	1	
Oriental,	2	3	Qualities,		3	Up-to-date,	1					Too anxious		2	Poor ad.,	1	2
			Busin's-like		4	Size	1		No. 2–Good ad.,	5	1				Prize,		1

Reason.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Age,	31	7	18	8	7	4	5	6	3	2	1	1
Reliable,	12	11	13	5	7	12	3	2	2			1
Good ad.,	2	6	7	4	3	2	5		5		1	1
Size,	3	2	12	3	26	8	11	4	6	4		
Price,	3		5	1	5	2						1
Money refunded,	2	4	3	1	7	2	12	5	1	3	1	1
Style,	1		3	7		3	6	4	2	3		
No reason,					1		2	1	11		5	3
Bargains Cheap,	6		3	2	11	3	10	9	29	11	20	20
Brag,									1	4	7	1
No good,				1			2	3	1	4	26	5

TABLE XVIII. House Furnishings.--The Two Ad's Most Chosen Under Each Choice.

First Choice.	M.	F.	Second Choice.	M.	F.	Third Choice.	M.	F.	Fourth Choice.	M.	F.	Fifth Choice.	M.	F.	Sixth Choice.	M.	F.
No. 5–Reliable,	9	1	No. 2–Good ad.,	8		No. 6–Style,	5		No. 1–Credits,	6	4	No. 3–Cheap,	16	7	No. 4–Cheap,	12	9
Age,	14	3	Moderate,	3		Novelty,	2	2	Good ad.,	5	3	Plain ad.,	1		Brag,	3	4
Good ad.,	1		Reliable,	2	3	Inviting,	4		High inter't,	2		Brag,	2		Sound,	3	
Pers'nal firm		1	Stylish,	3		Good ad.,	3		Experiment,	1		Compulsory		1	Fake,	2	1
No. 6–Refined,	6	1	Choice,	1		Impartial,		1	Brag,	1		Fake,		1	Dept. store,	2	
Up-to-date,	2	3	Novelty,		2	Oriental,	1		No reason,	1	1	Vague,		1	No reason,	1	
Oriental,	2	3	Qualities,		3	Up-to-date,	1		No. 2–Good ad.,	5	1	Too anxious		2	Poor ad.,	1	2
Reliable,		4	Busin's-like,		4	Size,	1		Qualities,	3	1	No. 2–Poor ad.,	3	2	Prize,		1
Novelties,		3	No. 3–Cheap,	9		High price,	1		Style,	1	2	Good ad.,	3	2	Too positive		1
Simple,		1	Bargains,	3	2	Reliable,	1		Cheap,	1		Styles,	1		No. 1–No reason,	5	
Desirability,		1	Witty,	1		No. 2–Good ad.,	6	3	Reliable,		1	Goods nam.,	1		Suspicious,	2	1
Experience,		1	No reason,	1		Reliable,		2	Prices not stated,	1		Fake,	1		Cheap,	2	
						Cheap,	1		No reason,	3		Brag,	1		High inter't,	2	
						Novelty,	1	1				No reason,	4		No credit,	6	5
						Style,	1	1							Credit,	1	1
						Substantial,	1								Poor ad.,	1	
						Size,		1							Small stock,		2
						No reason,	1	1									

Summary of Main Reasons for Each Choice of House Furnishings.

Reason.	1st Choi.		2d Choice		3d Choice		4th Choi.		5th Choi.		6th Choi,	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Age,	17	3	1	1	5	1	4	4	2	4		
Reliable,	14	8	12	12	9	9	5	3		1		
Good ad.,	12		14	7	16	9	13	5	5	2	4	
Style,	6	4	1		10	1	8	3	5	2		
Credit,	5		5		4	2	7	4	6	1	1	6
Size,		1	4	3	5	1	2	2	1			
No reason,			2	1	2	1	5	1	8	3	7	
Cheap,		5	17	2	11	7	12	3	19	7	15	16
Poor ad.,									9	8	5	8
Brag,							2		7		8	1
Fake,								3	2	1	9	

TABLE XIX. Clothes and Dress Goods.--Two Ad's Most Chosen Under Each Choice.

First Choice.	M.	F.	Second Choice.	M.	F.	Third Choice.	M.	F.	Fourth Choice.	M.	F.	Fifth Choice.	M.	F.	Sixth Choice.	M.	F.
No. 1–Age,	22	4	No. 6–Age,	13	4	No. 2–Size,	24	8	No. 3–Money ref.,	12	5	No. 4–Cheap,	17	3	No. 5–Cheap,	15	9
Reliable,	10	3	Reliable,	10	1	Attractive,	1		Style,	4		No good,	2	3	No good,	5	
Good ad.,	1	3	Attractive,	4		Reliable,	1	2	No brag,	1		Good ad.,	2		Jews,	1	
No brag,	3		Modest,	3		No reason,	1		No good,	2	2	Guarantee,	2		Brag,	2	
Exclusive,	3	1	Good ad.,	2		Reputation,	1	1	Up-to-date,	1	2	No bargains,	2		Fake,	5	4
Too brief,		1	Reasonable,	1					No reason,	1		No reason,	4		Fair ad.,	1	
Name,	1		Location,	1	1	No. 3–Money ref.,	7	1	Jewish,	2		Stylish,		3	Like Olson's,		1
						Up-to-date,	2		Good ad.,	2		Prices right,		1			
No. 6–Age,	6	2	No. 2–Size,	10	3	Large house,	1		Dislike,		1				No. 3–Money ref.,	1	1
Reliable,	2	6	Up-to-date,	1		Stylish,		2				No. 5–Cheap,	10	6	Brag,	2	
No brag,	2	1	Practical ad.	1					No. 4–Reasonable,	10	4	Size,	1		No good,	4	1
			Good goods,		1				Honest,	1		No reason,	2		Fake,	6	
									Attractive,	1		Brag,	1	1	Cheap,	2	
									Prices stated	1	4	Samples,		1	High price,		1
									Plain ad.,	1		No good,		1			

Summary of Main Reasons for Each Choice of Clothes and Dress Goods.

Reason.	1st Choi.		2d Choice		3d Choice		4th Choi.		5th Choi.		6th Choi.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Age,	31	7	18	8	7	4	5	6	3	2	1	1
Reliable,	12	11	13	5	7	12	3	2	2			1
Good ad.,	2	6	7	4	3	2	5		5		1	1
Size,	3	2	12	3	26	8	11	4	6	4		
Price,	3		5	1	5	2						1
Money refunded,	2	4	3	1	7	2	12	5	1	3	1	1
Style,	1		3	7		3	6	4	2	3		
No reason,					1		2	1	11		5	3
Bargains Cheap,	6		3	2	11	3	10	9	29	11	20	20
Brag,									1	4	7	1
No good,				1			2	3	1	4	26	5

given for choosing the first place; then follows government test and cheapness with the M., while purity and generally "attractive ad." with the F. The reason most unanimously given for the last choice is the prize offered in No. 5; it being characterized so largely by the F. as a fake is due to this also. Cheapness is the second largest reason given for last choice, and the first reason for next to the last choice.

Between these reasons determining the extremes of first and last choice is that of patronizing home manufactures, which appears strong for third or fourth choice; while the fact that for fourth and fifth choices no reason could often be given shows that these choices were more indifferent and considerably matters of chance.

The following were the set of ads. for pianos:

PIANOS.

No. 1. Greatest Slaughter Sale of Pianos on Record.
We have got to realize cash on our stock of elegant "Goldstein" Pianos within thirty days. Twenty-five up-to-date styles. Come early and get your first choice at your own price.
Anglo-American Piano Co.

No. 2. The old reliable "Columbia" pianos are still offered at right prices by the old established house of Wm. Brown & Sons. For sixty years made on honor; sold on merit.

No. 3. The "Paderewski" Pianos appeal to the most critical musical taste, and are receiving more favorable comment today than any other make of piano offered to the public. Their leading features are Scientific Scale, Purity and Character of Tone, Sympathetic and Responsive Touch, Beauty and Modernity of Cases.
Imperial Music Co.

No. 4. The "Blumengarten" Piano is used exclusively by the following artists: d'Albert, Rosenthal, de Pachmann, Rummel, Zeisler, Sherwood, Hofmann, McDowell, and many others.

No. 5. The Acme of Artistic Excellence. Our "Liszt" Pianos have taken First Prizes wherever exhibited; as, e. g., at the World's Fair and Paris Exposition, 1889. The David G. Jones Co.

No. 6. The "Æolian" Piano has been manufactured for the following crowned heads of Europe:
His Majesty, Nicholas II, The Czar of Russia.
His Majesty, William II, Emperor of Germany.
His Majesty, Franz Joseph, Emperor of Austria.
Her Majesty, Victoria, Queen of Great Britain.
His Majesty, Oscar II, King of Sweden and Norway.
His Majesty, Umberto I, The King of Italy.
Her Majesty, The Queen of Spain.
For Sale by The International Piano Co.

Only the two ads. most often taken for each choice are given in the results in Table XVII, tho each ad. was chosen

somewhat for each choice. The classification of the main reasons shows that age is again the chief reason for first choice; because reliability really should be counted with age. For all our tests show that these two reasons were usually given for the same ad. and that the reliability was an inference from the age of the firm. But in expensive articles like pianos, where much experience and technical judgment was far more necessary than in less expensive things like soap, the recommendations of well known piano players had the next influence in determining the purchaser. Thus too the prizes gained in No. 5 was likewise taken as a recommendation of experienced judgment. Where however the person knew or suspected that such ads. were not genuine, it caused quite a number to put Nos. 4 and 5 among the later choices or even avoid them as "fakes". Cheapness naturally influences less people in favor and more against a piano than in the case of soap, for more people would take some risk with a cheap soap than with a cheap piano. Royal approval was about the 5th reason on the whole, tho quite a number gave it for one of the first three choices. This reason and its imposing list of royalty was cut from an ad. published in *Science* and by one of the best and oldest piano firms. It struck me on seeing it that this was a weak motive for impressing the readers of that periodical especially; and that the extremely subordinate importance in the original ad. of the scientific and aesthetic originality of the old firm should be made the chief motive to buy their instruments.

The following were the ads for house-furnishings:

HOUSE-FURNISHINGS.

No. 1. House Furnishings. At "The Jamestown".
All on time if you desire.

No. 2. For Style, Novelty, Durability, and Price go to the
Household Outfitting Co.

No. 3. Forced Sale. Our usual Mid-winter Clearance Sale is this year a Forced Sale. We have the goods you need: you have the cash: we must exchange with you. All our prices cut in two; so you must come to us.
Purveyors to the Home Co.

No. 4. Swanson's Mammoth in the ring again with a complete house on its back. You can't think of an article for the house we don't carry. We'll give you a pound of our best coffee if you can prove anything wanting on our eight quarter-block floors.
For prices too, how's this?
Complete bed room set, mahogonized, $29.24
Constantinople Rug, 14 x 12 ft., $8.79

No. 5. The well-known House of Pierce & Wessen, who started your fathers and mothers in Housekeeping, are ready to start your generation likewise in the best way.

No. 6. Mr. Speedwith Bristed Leadbeater presents his compliments for the New Year, and, having just returned from another oriental trip with many exclusive novelties, he is prepared to furnish houses in the highest and latest aesthetic taste.

Here, in Table XVIII the previous highest value of age and reliability was superseded in the F. answers by the oriental, up-to-date and novelty attractions of No. 6; which with the M. was chosen most for third choice. The special attraction of credit in No. 1 led five M. to choose it for first and second place each; and tho it had the most votes for third choice, its emphasized credit feature made people so suspicious of it that it was only after No. 4 for last choice.

The following were the ads. for clothes for men and dress goods for women:

MEN'S CLOTHES.

(For men only)

No. 1. Charles A. James, Tailor. Established 1858.
Palace Hotel Corner.

No. 2. Philadelphia Clothing Co. Outfitters for the best tailor-made and ready-made clothing at right prices.
We have a store in each of the 15 largest cities of the U. S.

No. 3. For Nobby styles and incomparable prices visit us.
Money refunded as gladly as received if goods are not as represented. Diamond Clothing House.

No. 4. Bargain Sale. Up-to-date business suits, made to order, $17.85
All-wool, fast-color overcoat, made to order, $14.79
Best fitting pants in town, made to order, $4.98
Great Western Tailor Co.

No. 5. Liquidation Sale. We have bought the entire stock of superfine clothing of the celebrated firm of Rothenberg & Silberstein, N. Y., at 40 cts. on the dollar; and can thus give you your choice at less than cost.
Imperial Clothing Co.

No. 6. Gustav Weiss & Sons, Tailors; for 40 years at 10 Fifth St., up stairs. Genuine goods; best workmanship: reasonable prices.

DRESS GOODS.

(For Women Only)

No. 1. Ladies' Dress Goods a specialty at James & Co's. Established 1858. Palace Hotel Corner.

No. 2. Philadelphia Dry Goods Co. Sell the best dress goods of all kinds at right prices. We have a store in each of the 15 largest cities of the U. S.

No. 3. For the very latest Paris and New York styles in dress goods and at incomparable prices, visit us. Money refunded as cheerfully as received, if goods are not as represented.

"The Louvre".

No. 4 Bargain Sale. Freshest patterns of brocade silks $1.98
Taffetas in all the latest shades .59
The Nobbiest of golf suitings 2.17

Great Western Dry Goods Co.

No. 5. Salesmen Samples. We have bought these Shirtwaists samples from the superfine house of Rothenberg & Silberstein, New York, at 40 cts on the dollar, and can thus give you your choice at less than cost.

"The New Imperial".

No. 6. Gustav Weiss and Sons. Still at their old location on Short St. (just off from Main St.), where they have been for 40 years. Genuine goods; courteous attendance; reasonable prices.

In these answers in Table XIX the first and second choices were determined by the age and reliability of Nos. 1 and 6, the F. keeping by No. 1 for both. But in this set the element of size comes in to determine the plurality for No. 2 as third choice. There were even several middle choices of No. 4 in the previous set of house-keeping ads. because of its size. The money refunded motive, like the credit one of the preceeding set, mainly centered in the fourth choice. The modest location of No. 6, as compared with No. 1, seemed to consciously influence a few men only.

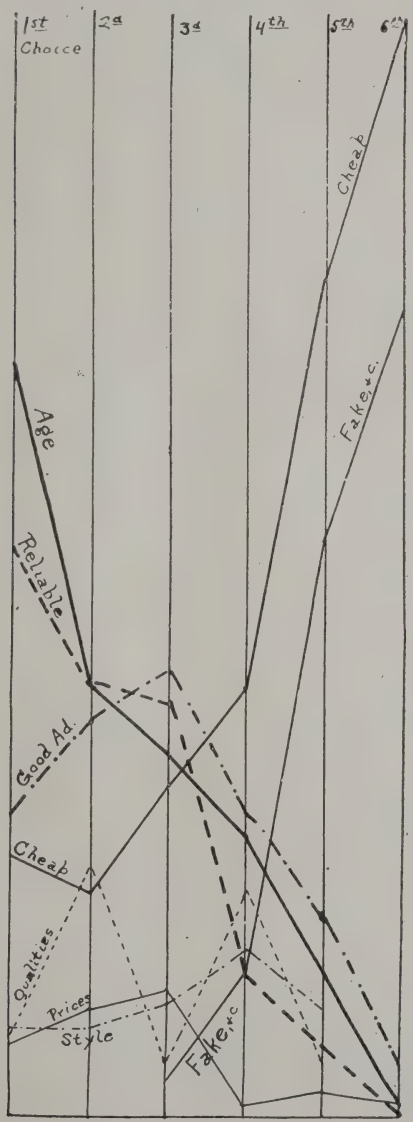
An interesting final summary is made by adding together all the replies to eight of the main reasons which were present and given in each set of ads.; and these are given in the following Table XX.

TABLE XX.

SUMMARY FROM THE FOUR SETS OF ADS. OF THE MAIN REASONS FOR OR AGAINST AN AD.; FOLLOWED THRO SIX CHOICES.

REASON.	1st Choice.		2d Choice.		3d Choice.		4th Choice.		5th Choice.		6th Choice.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Age.....	75	21	38	17	36	10	23	13	11	8	1	1
Reliable.....	46	29	34	21	26	27	13	6	8	2	....	1
Attractive, Good Ad..	23	15	31	19	30	27	29	10	17	9	5	2
Cheap, Bargains..	24	9	23	5	27	15	37	18	74	33	70	71
Qualities Stated.....	5	5	20	11	5	1	20	8	5	3	....	....
Prices Stated.....	8	1	12	1	9	7	1	....	3	....	1	1
Style.....	7	4	4	7	10	4	14	7	9	5	....	....
Fake, Brag, No Good..	....	....	....	....	3	1	10	9	51	24	68	35

Remembering that the proportion of male to female answers are about two to one, it appears from this table that the men were proportionately a little more influenced by age and the women by reliability and by what they called an attractive or good ad. Contrary to our expectations and to the information from experienced advertisers, it appears that cheapness influenced our male answers more in favor of an ad. and the females more against an ad. But there were too few female answers upon which to base any certain differences between the sexes.



When, however, both sexes are added together from Table XX and the totals plotted in diagrammatic curves they make up Fig. 3.

FIG. 3.

DIAGRAMMATIC SUMMARY FOR BOTH SEXES OF THE MAIN REASONS FOR CHOOSING AN AD. FROM SIX POSSIBLE ONES.

Here the six choices are represented by the vertical lines "1st choice," "2d choice," etc. The distances upwards from the horizontal base line are the proportionate values for each reason for each of the six choices. Thus the reason most given for first choice was "age," and tho it was given less for second choice it was still the reason most given, along with "reliable." Age was gradually given less for the later choices, till

it was hardly mentioned for last choice. The second most prevalent reason for first choice was "reliable," and it decreased thro the later choices with more fluctuation than age did. The third most frequent reason for first choice was the general or indescribable one of "good ad." or "attractive ad." This reason was given 24 times for choosing No. 1 in the soap set, where the "attractive" itself probably suggested this reason to some; and it was given 10 times for No. 2, where it apparently meant reliable. In the piano set it was given most often for No. 3 and next for No. 2; in the house-furnishing set the great majority were for No. 2, and only a quarter as many for Nos. 6 and 1 each. For the last double set of clothes and dress goods a slight excess were for Nos. 1 and 6. Thus as the ads. which were called good or attractive were in quite a majority of cases those giving a description or stating the qualities of the articles and in the minority of cases were those in which the age or reliability was the chief element, this category of "good ad." should justly be divided, adding the larger part to the reason of "qualities stated" and a smaller part to "age" or "reliable." But the good ad. category has been kept in the diagram as showing how unconsciously many people reason, and cannot indeed give the real reason when they try. This unanalyzable attractiveness increased too in the second and third choices and then decreased. Similarly another category for unconscious reasoning might be made from the "no reason" answers. This unanalyzable class reaches a maximum at the fourth or fifth choice; but they are so scattered among the different kinds of ads. that it is not possible to partition them as we might the above "good ads."

The curve for cheapness shows that it is the fourth reason for the first choice, being about one-third the value of age; that after a slight decrease for second choice it takes medium and high places for third and fourth choices, and then with a sudden bound upward shows itself overwhelmingly the reason for making the last two choices. In "cheap" are included also "bargains," which, being a somewhat different and better reason, appears among the first choices and so has tended to raise the beginning of the cheap curve.

The attractive force of "qualities stated" fluctuates much as the fifth reason for the middle choices; but it must be remembered that the larger part of the "good ad." answers must

really be reckoned with these quality stated ones, and would thus raise this reason to a higher and more uniform curve.

"Style" kept a low value on the whole, being most effective for fourth choice. But this supposed prevalent reason, due to the pleasure in imitation, did not probably have a fair chance in our four articles and their ads. for it scarcely appeared at all for soaps and pianos. It appeared most in house-furnishings and considerably less in clothes and dress goods. "Prices stated" about equaled the low level of style for the first three choices, and then fell to almost no influence.

The peculiar class of reasons grouped under "fake, brag, no good" only started in with the third choice, but rapidly increasing they made a parallel to cheapness as the two reasons for most avoiding a firm. These reasons were given most frequently against Nos. 5, 1, and 3 in soaps; Nos. 3, 6, and 1 in pianos; Nos. 4, 2, 5, and 6 in house-furnishings; and Nos. 5, 3, and 4 in clothes and dress goods. Thus this indefinite class of reasons against an ad. seem to be a mixture of cheapness, incredibility, and distrust.

Taken altogether the answers to these four sets on the reasons for buying show that about 60% of our answers made their first choice from the age or reliability of the firm. This seems to show that they tried to substitute for their own want of experience with these firms the experience of the public who had dealt with them. Many of our answers objected vigorously to having to choose a firm without a chance to get the advice of some friend or person who knew the firms. Thus we were surprised that not more were influenced by the more strictly advertising elements of novelty, curiosity, style, and cheapness. But this result by this method gives much confirmation to our earlier tests on the proportion of people influenced by advertising. (See p. 58 above.)

Summary.

The main results of our various studies at tracing the mental processes effected by advertisements can be summarized as follows:

1. Attention: (a) Best gained on the whole by relevant words or text matter, next by relevant and irrelevant cuts, and least by irrelevant words.

   (b) Thro five repetitions the relevant words increased steadily in value, while the cuts decreased, and the irrelevant words remained on their initially low level.

(c) The female observers were attracted proportionally more than the males by cuts and by irrelevancy.

(d) In colors, males were attracted mostly by black and green, females by red and green.

(e) A progressive increase of attention within the sizes of type from 2 to 5 mm. high.

(f) The left side of the page was seen more than the right.

(g) The horizontal quarter above the middle was on the whole more effective than the other quarters, with the bottom quarter decidedly least valuable.

(h) Only about half our informants seemed to be influenced consciously by advertising; the females somewhat more than the males, however. But a considerable amount of advertising acts upon people below the threshold of their conscious attention and memories.

2. The reasons given for choosing one advertisement over others as the place from which to buy were:—

(a) Decidedly foremost from the age or reliability of the firm; then from cheapness, statement of qualities, with statement of prices and style least effective.

(b) For last choice cheapness was by far the main reason, either directly or under the brand of "fake," while an unanalyzable distrust and suspicion from too great claims or details was next operative.

What practical inferences can be gathered from these experiments in advertising and how far the conditions and results of these experimental trials can be applied to the real conditions of magazine or other advertising one without practical experience must of course be very cautious about suggesting. How far our little group of observers from University students and their family circles are representatives of the advertising-reading public is hard to determine. But they seem fairly representative of the educated merchantile and professional grades as against the laboring classes. Where only the University students of the two upper classes furnished our data, it must be remembered that they are most all city-bred and still dependent on paternal support; so that perhaps they have not become as keen advertising-readers and bargain-seekers as they may be later. But I am quite inclined to believe from these trials that for the advertising of firms and for articles of more permanent use a plain statement in relevant words of the firm or name with the article, and in some permanent trade mark form, is on the whole most effective for attention, combined with inducing real buying. This effect will probably be much increased by a relevant cut, if it can show anything distinctive of that particular article or firm, for we learn much easier thro sight of the real thing or its picture than thro a word or

verbal description. But cuts which only show the general class of the thing advertised, as a nondescript bicycle or typewriter, seem doubtful as to any high attention value and do not give any information leading one to buy that particular article. The irrelevant cuts have considerable temporary attention value, and irrelevant words less so; yet this seems considerably counteracted by weakening the buying value, because of associations of shoddiness or insincere desperation, as in sensational fire-sales or even shown in much modern church and Y. M. C. A. advertising. There is, to be sure, in most adults as in children, so great a pleasure in novelty that, as the records of our trials show, all our observers usually saw a different thing with each successive sight at a sheet. But amid this shifting of the attention due to the pleasure in novelty the plain words seem to have on the whole the greatest value.

After getting the attention there is one effect we have not considered, but a most important one practically and extremely interesting psychologically. This is the unconscious effect of finally buying an article which has been continually reiterated before our half-conscious eyes. Having the simple name constantly forced before one's indirect vision is enough to make many people react sufficiently to get the article. And this without necessarily any curiosity or other reason, but simply as a case under our general law of sensori-motor or idea-motor reaction. This law merely sums up the natural tendencies to put into motion and carry out any perception or idea we may get. Thus the final buying of the often-impressed article is very similar to all the forms of suggestion—within hypnotism or in the commoner forms about us every day—which are being recognized as forming such a large part of our motor life.

But if an advertiser wants to reason with his public, then a simple statement of his age and experience, with any genuine evidences of fair dealing and of approval, seem the best means of supplying the buyer's desire for experience. As one of our informants said, "The best advertisement is a well-satisfied customer." Thus a vast amount of ingenuity and capital seem misspent in many of the modern schemes of advertising which appeal chiefly to novelty, curiosity, cheapness and excitement.

Harlow Gale.

THE VOCABULARIES OF THREE CHILDREN OF ONE FAMILY TO TWO AND A HALF YEARS OF AGE.

BY M. C. AND H. GALE.

The first child, "1, girl," was watched daily by her mother, who was so constantly with her as to be seldom an hour at most away from her, and the child's new words were recorded each day. The preliminary noting of the new words as heard was done on slips of paper kept conveniently at hand in two or three parts of the house. Once or twice a week we sat down together and recorded these slips permanently in chronological order in the child's psychological diary, along with much other matter of daily observatiou and experiment.* Of course relying thus on one's memory of the past vocabulary there was some danger of recording a word twice, even when running over the past lists. But any such duplicates were found and cancelled by making also an alphabetical list from the chronological list. Thus if there was any suspicion as to a word's being new it was noted on the preliminary slips, and if not readily found on the permanent chronological list (which was not always easy to do when, e. g., the nouns came to amount to from 500 to 800), its duplication was prevented when the indexed list was made at the end of the two and a half year period.

In the case of the second child, "2, boy," two years younger, we found he was using many more words; and suspecting we were not getting them all recorded by the first method of relying on our memory for catching the new words, we had recourse to an additional method. This consisted in following him about twice with pad and pencil all his waking day, just before he was two and when he was two and a half years old, and taking down all his entire talk for those days. On classifying these words in an alphabetical index and comparing them with the chronological list we found to our astonishment

*The considerable experience thus gained in following the children's use of language is however only a small part of the work expended during the past seven years in our entire observations and experiments in the psychological development of our three children and which we are still continuing. The main interest and problems with us were in the process of gaining knowledge and of reasoning, and also in the other mental element of pleasure-pain as the basis of their ethical and æsthetical life. As these main results cannot be made public for several years we publish this chapter on their vocabularies because it is fairly completed.

that he used about 270 words in these two days which we then recognized as having been used before and yet which we had missed in the daily record.

So in the case of the third child, "3, girl," again two years and two months younger, we used this check more thoroughly by taking all her words used on the first days of the months 20, 21, 22, 23, 24, 25, 28, and 31. Thus we had eight complete days' use of language to compare with the observed new words in the chronological list and to make about 250 additions toward a completer vocabulary of the child.

As to what constituted a word, we considered it as every sound associated with a particular perception, idea or action, when this sound was used spontaneously and repeatedly. This excluded sounds used in immediate imitation as in echolalia and in nursery rhymes as mere verbal motor memory. Thus when different sounds were associated with the same thing, as Dick and Dicksie (as well as Mary and Dick) for the same person, they were counted as separate words; as also when the same sounds were associated with different things, as the sound "wah" for a glass of water and for the act of drinking. When, however, there was a progressive and traceable change of the sound for the same thing these were not counted as different words. The singulars, plurals, and possessives of nouns, the different persons, tenses, and modes of verbs,—these were counted as different words when, as different sounds, they required a new association.

The words used in adult speech are given in the vocabularies instead of the sounds used by the children, tho the latter were also recorded up to two years at least.

In the classification of the words as parts of speech we tried to follow as simple and psychological a plan as possible instead of too technical grammatical lines. Thus past and present participles were put under adjectives. Where a word was used grammatically both as an adjective and an adverb, but with the same associated idea, it was placed under one category as, e. g., "high" in "high house" and "swing high." Interjections allowed much latitude which, however, we tried not to use too freely.

What constitutes a vocabulary is not an exact matter; for many words are used freely a short time and then dropped. But with our children it seems to us that but few are dropped because of the object of the word having disappeared from the

child's world, as by a change of nurse girls or the loss of a book; but far more by changes in the child's interests or pleasure-pains. Few of the latter class of words could then be regarded as certainly vanished from the child's vocabulary, for with a renewal of interest in the thing the word would be again used. Thus with the danger of arbitrary exclusion if we tried to judge what was really dropped we have included all the words used up to any date as the vocabulary at that date.

In the following vocabularies then are given all the words corresponding to the sounds used by the three children up to two and a half years of age, as completely and in as true a chronological order of their acquirement as we could record. Because of its fuller completeness and divisions into months the vocabulary of the third child has been taken as the basis in the left column. The numbered list of the second child was added to that of the third child, as far as they had the same vocabulary in common, by placing an S and the number in its order of acquisition after the same word in the basis list. The remaining words used by the second child and not by the third are added in a separate column to the right and in the corresponding month or period of their acquirement. Similarly the vocabulary of the first child is added to the basis list by the letter M and the number of the word in its order of her acquirement. What words she had in common with the second child only were similarly added to his extra list; what she used alone were added as a third column to the right in the proper period of their acquisition.

NOUNS.

3, H. Girl.	2, S. Boy.	1, M. Girl.
Mo. 15.		Mo. 20.
1 baby S 73. M 1.	Katie	Sambo
2 cow S 5. M 39.	holly	Gust
Mo. 17.	dark place	onions
3 Papa S 3. M 5.	Fred M 132	tickle-spot
4 book S 9. M 11.	tail	fall
5 horse S 49. M 38.	toboggan	
6 Mamma S 4. M 6.		
7 dog S 2. M 27.		
Mo. 18.		
8 lady S 167.		
9 Dick S 24.		
10 bottle S 31. M. 18.		
11 pillow S 90. M. 59.		
12 water S 139. M 105.		
13 doll S 19. M 97.		
14 pin S 13. M 25.		

3, H. Girl.

Mo. 18. (Continued)
15 bonnet S 15. M 114.
16 mittens S 16. M 24.
17 drink S 752.

Mo. 19.
18 kitty S 1. M 28.
19 dishes S 17. M 158.
20 Ida.
21 dress S 346. M 20.
22 block S 21. M 243.
23 hand S 66. M 36.
24 ball S 22. M 47.
25 bird S 54. M 29.
26 lamb.
27 girl S 150. M 4.
28 boy S 151. M 3.
29 shoe S 50. M 19.
30 bear S 72. M 312.
31 toad.
32 fish S 436. M 196.
33 pig S 107. M. 62.
34 Sammy S 168.
35 stocking S 36. M 186.
36 orange S 85. M 48.
37 box S 8. M 12.
38 eye S 51. M 50.
39 flower S 103. M 48.
40 scissors S 11. M. 26.
41 paper S 10. M 40.
42 spoon S 18. M 43.
43 egg S 63. M 172.
44 pee-pee-pot S 128.
45 Grandma S 45. M 10.
46 story S 598. M 101.
47 chair S 23. M 65.
48 bed S 41. M 58.
49 bread S 29. M 16.
50 Carl.
51 chicken S 149. M 30.
52 rat. M 260.
53 rusk.
54 slate S 728.
55 toes S 114.

Mo. 20.
56 barn S 178. M 183.
57 fire S 380. M 55.
58 Grandpa S 46. M 9.
59 hat S 83. M 22.
60 Helen S 104. M 41.
61 lamp S 543.
62 owl S 400. M 230.
63 picture S 39. M 86.
64 Hilde.
65 Jack S 200. M 164.
66 teapot S 657. M 256.
67 cake S 30. M 91.
68 soap S 277. M 100.
69 cloth S 328. M 120.
70 fox. M 302.
71 frog. M 213.
72 panties S 186. M 136.

2, S. Boy.

Mo. 19 to 23.
ark
Noah
paint-box
nigger-book M 245
cloak
beads M 406
bib M 323
trap
Hottentot
dust-cloth
Idylla
colors
Brownie M 121
sleigh M 415
Dolly-Gale M 334
hoop
salt-cellar
shade
sunshine
Polly
hall M 344
Margaret
Philip M 405
dirt M 351
mud
feather M 435
cuff
knob
Mark
German doll
swan
tick-clock

1, M.

Mo. 20 to 24
kiss
fried-cakes
ride
Uncle Rob
Uncle William
Uncle Charles
Beatrice
Elsie
aunt
Alexander
yard

3, H. Girl.

Mo. 20. (Continued)

73 wolf S 611.
74 candy S 347. M 15.
75 rabbit S 117. M 159.
76 lap S 382. M 221.
77 sand S 214. M 216.
78 mouse S 306. M 259.
79 jacket S 199. M 168.
80 strings.
81 man S 26. M 7.
82 robin S 398. M 309.
83 boat S 258. M 147.
84 car.
85 cookie S 230. M 17.
86 brush S 32. M 23.
87 sponge S 71.
88 tights S 636.
89 bicycle S 172. M 116.
90 waist S 275. M 145.
91 blouse.
92 bag S 67. M 208.
93 Patsy S 222. M 181.
94 stool S 626. M 431.
95 garter-straps S 187.
96 cocoa S 158. M 389.
97 coat.
98 whip S 208.
99 package S 109. M 408.
100 door S 27. M 61.
101 petticoat S 35. M 128.
102 cheek. M 442.
103 stone S 179. M 139.
104 apple S 507. M 392.
105 cherries.
106 grass S 185. M 130.
107 doctor S 572.
108 Nettie S 7. M 32.
109 fun S 596.
110 park S 225.
111 duck S 34.
112 basket S 12. M 84.
113 sleeve S 112. M 144.
114 meat S 121. M 102.
115 handkerchief S 118. M 159
116 face S 519. M 94.
117 gun S 220.
118 pencil S 37. M 71.
119 cracker S 105. M 98.
120 chin S 215. M 340.
121 broom S 97.
122 chalk S 504.
123 medicine S 421. M 296.
124 things S 702. M 165.
125 night gown S 58. M 81.
126 Francis.
127 neck S 215. M 68.
128 head S 77. M 201.
129 pail S 55. M 244.
130 mouth S 33. M 75.
131 balloon S 386.
132 bell S 59. M 198.
133 cart S 20. M 174.

3, H. Girl.

Mo. 20. (Continued)

134 carriage S 61. M 80.
135 comb S 327. M 73.
136 Mary S 536. M 33.
137 monkey. M 348.
138 penny S 155. M 280.
139 Peter.
140 playhouse.
141 potato S 193. M 13.
142 Robbie.
143 stick S 106. M 138.
144 store. M 197.
145 toast S 130. M 202.

Mo. 21.

146 Emily S 144.
147 puzzle.
148 sugar S 102. M 89.
149 stove S 188. M 319.
150 Decke S 25.
151 calf. M 220.
152 key S 82. M 127.
153 oat meal S 359. M 87.
154 sash.
155 Hulda.
156 Anna.
157 sister S 189.
158 hair S 78. M 190.
159 nose S 42. M 49.
160 ear. M 69.
161 cap S 171. M 229.
162 fairy S 789.
163 finger S 243. M 111.
164 honey.
165 clock S 38. M 35.
166 curl S 392. M 211.
167 teeth. M 70.
168 kitchen S 264. M 141.
169 napkin S 70. M 240.
170 thimble. M 110.
171 nap S 217. M 149.
172 pad S 393.
173 matter S 628. M 363
174 leg S 153.
175 plate S 69. M 66.
176 floor S 135. M 156.
177 tub S 91. M 37.
178 berries.
179 sweater.
180 banana S 84. M 185.
181 glass S 340. M 179.
182 tree S 286. M 92.
183 feet S 538. M 93.
184 moon S 75. M 42.
185 marble S 166.
186 pony S 273. M 276.
187 dinner S 196. M 99.
188 bars S 447.
189 fly S 241. M 206.
190 pitcher S 473. M 150.
191 table S 257. M 108.
192 Brille S 64. M 361.
193 painter.

3, H. Girl.

Mo. 21. (Continued)

194 house S 224. M 60.
195 dandelion S 278.
196 milk S 60. M 79.
197 towel S 81. M 104.
198 sauce.
199 buggy.
200 umbrella S 180. M 182.
201 Nancy.
202 piece S 192. M 119.
203 pegs.
204 school.
205 button S 44. M 170.
206 rubbers S 195. M 131.
207 saw.
208 train.
209 knife S 159. M 322.
210 didie S 74. M 67.
211 bran.
212 hammer S 317. M 204.
213 nail S 373. M 194.
214 children S 65. M 218.
215 wood S 210. M 54.
216 pocket S 100. M 416.
217 Mr. Curtis.
218 wheel-barrow S 407.
219 hoe.
220 needle S 56. M 34.
221 hugger-sucker.
222 bossy.
223 bug. M 215.
224 spot.
225 dock.
226 Fluffy.
227 room S 201. M 113.
228 ribbon S 284.
229 neck-tie S 355. M 381.
230 belt S 287. M 387.
231 bit S 345. M 427.
232 butter S 381. M 106.
233 candle.
234 clothes S 705. M 21.
235 chu-chu S 350. M 123.
236 cowsie.
237 cup S 170. M 148.
238 finger-nail. M 112.
239 gasoline.
240 Momsie.
241 party S 724.
242 plant.
243 Popsie.
244 pudding.
245 rainbow S 682.
246 shovel S 209. M 210.
247 steamboat S 430. M 234.
248 wind S 362. M 129.

3, H. Girl.

Mo. 22.

249 flag S 110. M 231.
250 board S 184. M 203.
251 spread.
252 matches. M 143.
253 stomach S 203. M 162.
254 shirt S 356.
255 sheet S 360. M 250.
256 sailboat S 431.
257 supper S 236. M 441.
258 breakfast S 197.
259 trousers S 608.
260 Brightwood S 463.
261 cover S 326. M 357.
262 chain S 294.
263 brother. M 261.
264 night S 204. M 337.
265 pansy
266 nipple S 266.
267 town.
268 cream S 262. M 107.
269 vasoline S 141. M 277.
270 bench S 450.
271 Dick-a-wee.
272 biscuit S 292. M 224.
273 noise S 269. M 352.
274 closet S 341. M 238.
275 drawer S 157. M 137.
276 caterpillar.
277 shawl S 93.
278 hammock S 283. M 204.
279 nest.
280 way S 276. M 444.
281 collar S 353. M 383.
282 lettuce S 769.
283 apron S 164. M160.
284 windmill S 631.
285 seat S 384.
286 music S 122. M 169.
287 cradle S 267. M 52.
288 thread S 194. M 184.
289 porch S 279. M 189.
290 beans.
291 fan S 451. M 85.
292 Hilsie.
293 knee S 165. M 96.
294 Cursie.
295 plum.
296 rag.
297 Samsie.
298 shop.
299 stairs S 28. M 64.
300 garden S 301.
301 rain S 207. M 124.

3, H. Girl.

Mo. 23.
302 hatchet.
303 putty.
304 rice.
305 sack S 465.
306 sky. M 214.
307 tooth S 531.
308 lookout.
309 peas S 302. M 228.
310 cottage-cheese.
311 juice.
312 slippers S 205. M 239.
313 codfish-ball.
314 "goops."
315 sofa S 377. M 287.
316 picture-book. M 255.
317 ice S 290. M 222.
318 slop-pail.
319 watch S 525. M 409.
320 Grandpa Gale.
321 Gale S 415. M 264.
322 sword.
323 button-hole.
324 pillow-case S 753. M 115.
325 cork S 40. M 200.
326 field-mouse.
327 bachelor's-button.
338 marigold.
329 minute S 406.
330 parasol S 517.
331 center-board.
332 Cape Cod.
333 shame.
334 Dorothy.
335 bath-house.
336 tacks.
337 Bauchknopf S 388. M 324.
338 mulberry-bush.
339 Bible.
340 spider-web.
341 Bullen's store.
342 Phillip's store.
343 rope S 129.
344 Grandpa Corser.
345 pole.
346 bed-clothes.
347 ring S 336.
348 crust S 465.
349 corner S 80. M 364.
350 leaf. M 445.
351 apple-sauce S 505. M 368.
352 balls.
353 bird's nest S 261.
354 black-stockings.
355 silk-stockings.
356 bread and butter.
357 corn S 568. M 46.
358 foot S 115.
359 garters. M 177.
360 hands.
361 legs. M 56.
362 nails.

2, S. Boy.

Mo. 23.
Jack-book
wringer
strawberries. M 117
perfumery. M 374
Boguey-man
arch
cube
hold
walk
team
stopper
bird-house
chocolate
Muddie
chimney
coffee. M 390
frame
jug
jewelry-box
button-box. M 235
front-seat
drum
ground. M 356
jug-man
Papa-chicken

3, H. Girl.	2, S. Boy.	1, M. Girl.
Mo. 23. (Continued)		
363 noses.		
364 Popsie Gale.		
365 shoegies.		
366 shoes S 701.		
367 toegie.		
Mo. 24.	Mo. 24.	Mo. 24.
368 Lake Park.	wagon. M 173	Rücken
369 bureau S 232. M 248.	croquet	shell
370 D. B.	Ecke. M 365	hay
371 frosting. M 377.	grocery-man	asparagus
372 G. B.	Aunt Isabel. M 151	high chair
373 Grandma Gale S 343.	Uncle Fred	work-basket
374 hook S 146.	pillow-rub	shore
375 ice-cream.	side-door	
376 jeans S 219.	cellar. M 285	
377 knees.	thunder	
378 lemon-ice.	ice-man	
379 lima beans.	tennis	
380 mache-wah.	wire	
381 Nancy's aunt.	sun. M 388	
382 place S 446.	gold-pin	
383 six inches.	bath. M 82.	
384 six and a half.	Minnie	
385 six o'clock.	Johnny	
386 slice S 695.	Minnetonka	
387 song S 484.	Mother-Hubbard book	
388 soup. M 282.	Mother-kitty	
389 wood-pile.	nigger	
390 blue-chair.	coffee-pot	
391 pink-shoes.	Bade-Zimmer	
392 headerci S 544.	Catherine. M 175	
393 Excelsior.	drop	
394 home S 324.	Edith	
395 ruler.	peep	
396 side S 318.	front. M 419	
397 letter S 182. M 195.	swing	
398 Big Island.	dining-room. M 289	
399 row-boat.	poll-parrot	
400 "Dein ist mein Herz."	basin	
401 Tagebuch S 291.	moth-ball	
402 screen-door.	sleep	
403 mast.	balloon-man	
404 fire-place.	circus	
405 Nancy Johnson.	awning	
406 button-basket.	alley	
407 knot S 539.	umbrella-bird	
408 Bart S 79. M 360.	goose. M 252	
409 tongue S 96. M 193.	blue-jay	
410 hole S 227. M 358.	sweet-peas	
411 bathing-suit 630.	beginning	
412 mosquito-bite.	river-water	
413 sprinkler.	fire-man	
414 sand-pile.	cent	
415 Goethe-book.	Tannenbaum	
416 tomatoes S 597.	troubadour	
417 snake S 754.	Rheingold	
418 Aunt Helen S 389.	Bonnie	
419 smoke S 314.	Gussie	
420 Grandma Gale's-room.		
421 milk-toast.		

3, H. Girl.

422 tin-cup.
423 jumping-jack.
424 rocking-chair S 173. M 233.
425 ginger-bread S 750.
426 snail-shell.
427 can.
428 flour.
429 gentleman S 498.
430 birthday S 567.
431 pocket-book S 101. M 126.
432 cape.
433 Dicksie.
434 hairpin S 255.
435 ladder.
436 mirror. M 72.

	2, S. Boy.	1, M. Girl.
Mo. 25 to 28.	Mo. 25 to 26.	Mo. 25 to 31.
437 arm S 330. M 192.	scissors- grinder	organ
438 birthday-candle.	ink. M 379	Samuel
439 boards.	sailor-boy	Tryon
440 candles.	Annie	Belknap
441 chocolate-cake	lawn	German-book
442 curls.	sprinkling-cart	circus-book
443 ears.	bouquet. M 440	Princess-book
444 eyes.	gate	Mother Goose-book
445 fence. M 384.	clover-blossom	Santa Claus-book
446 fingers.	hide-and-seek	Tiddy Toddy-book
447 fish-pole.	blueberries	purse
448 glue S 534. M 380.	line	roses
449 letter-paper.	graham-cracker	sitting-room
450 lot S 708.	balcony	nursery
451 marbles.	elephant. M 306	nurse
452 mattrass.	peanut	doctor-man
453 pee-pee.	peanut-man	pills
454 pan-cakes.	ceiling	hobby-horse
455 pins S 659.	Mary Ann	puppy
456 rake.	sore	camel
457 soldiers. M 314.	soap-suds	goat
458 cushion S 89. M 205.	steeple	giraffe
459 toe. M 191.	paint-brush	tiger
460 work.	ice-chest	rhinoceros
461 bath-room S 364. M 187.	wrapper	Christmas-tree
462 bath-tub.	thermometer	pillow-sham
463 side-porch.	tin	Nettie-doll
464 front-porch.	steam-engine	Helen-doll
465 back-hall.	Mr. Rait	new-doll
466 Oscar.	back-yard	lemon-drop
467 Emilia.	Yerxa's	cotton-batten
468 Augusta.	leaves	forehead
469 telephone.	posie	boiler
470 errands.	hose	spoon-holder
471 sewing-machine S 145. M 122.	mosquito	cider
472 front-door. S 310	pan. M 321	whiskey
473 nurse-girl.	bowl	wine
474 soldier-cap.	Lena	rattle
475 chocolate-candy	hearth	pear-sauce
476 French.	Elizabeth. M 133	negro
477 Deutsch.	cat	doughnut
478 fire-engine S 394.	foundation	cough
479 mail-man S 320. M 370.	mug	pepper
480 tea S 656. M 14.	conductor	quilt

	3, H. Girl.	2, S Boy.	1, M. Girl.
481	hot-water-bag S 482.	eye-shade	Hale & Thomas
482	lump S 510.		Alice O'Brien
483	folks.		deer
484	dumb-bell.		braid
485	chimney-sweep S 550.		hug
486	horn.		inside
487	carpet S 163. M 448.		outside
488	street S 361. M 343.		pinning-blanket
489	whistle S 136.		band
490	fruit.		socks
491	bridge S 240.		grate
492	shirt waist.		ruffle
493	pile.		jig
494	window S 253. M 95.		Jacob
495	University S 466. M 401.		birthday-party
496	Jimmy S 148.		Fair-Luna
497	gloves S 449. M 425.		
498	coal S 591.		
499	Mrs. Ireys.		
500	gas S 57. M 178.		
501	blackboard.		
502	lake S 462.		
503	Santa Claus S 370.		
504	Pantoffeln S 533. M 362.		
505	rug S 417.		
506	Grandpa's.		
507	time S 211. M 197.		
508	Japanese S 684.		
509	Jim S 200.		
510	piano. M 90.		
511	teams.		
512	table-cloth S 284. M 257.	Mo. 26 to 27.	
513	salt. M 142.	reception-room	
514	gravy S 237. M 223.	wood-shed	
515	clouds.	tennis-racquet	
516	furnace-fire.	cork-screw	
517	while S 514.	window-sill	
518	curtain. M 318.	music-room	
519	air S 503.	Hafergrütze	
520	wash-bowl S 497. M 225.	Mr. Goldsbury	
521	clothes-pin S 312. M 253.	worm	
522	type-writer.	attic. M 411	
523	wash-cloth S 471. M 251.	sieve	
524	molasses-candy S 652.	Dr. Damon	
525	hill S 303. M 376.	coach	
526	peppermint-candy S 663.	plenty	
527	tissue-paper.	bottom. M 417	
528	newspaper S 499. M 443.	"Blondes Köpfchen"	
529	blood S 305.	washerei	
530	bone S 132. M 241.	Mr. F's aunt	
531	railroad-track.	Cornelie	
532	jewelry.	somersault	
533	ticket.	Hildelein	
534	street-car S 334. M 53.		
535	rough-rider-suit.		
536	bow. M 355.		
537	nuisance.		
538	Pond's Extract S 133. M 375.		
539	court-plaster.		
540	Jack Frost.		
541	mark.		

3, H. Girl.

542 magazine S 624.
543 wrist.
544 shelf S 610. M 407.
545 wheel. M 301.
546 china-dishes.
547 front-room S 527.
548 writing-desk.
549 sidewalk S 280. M 342.
550 envelopes.
551 skin S 244.
552 wash-stand S 566. M 246.
553 tooth-brush S 313.
554 safety-pin S 365.
555 church S 295. M 385.
556 kind S 547.
557 screw S 555. M 327.
558 ice-box.
559 cream-pitcher.
560 money S 268. M 279.
561 sauce-dish.
562 saucer S 603. M 219.
563 lesson.
564 Moffla.
565 half-dollar.
566 animal-cracker. M 305.
567 soap-bubbles.

3, H. Girl.

568 Tam O'Shanter S 635.
569 bed-room. M 290.
570 baseball S 470.
571 lesson-book.
572 St. Paul.
573 cards S 98.
574 tape-measure S 440.
575 cheffonier S 367. M 247.
576 sun-bonnet.
577 flannel S 161.
578 cheese S 571.
579 pussy S 229.
580 Baby Blue Eyes.
581 Thanksgiving S 671.
582 Christmas S 677. M 316.
583 fiddle S 162.
584 afternoon S 511.
585 bunch S 429.
586 mantle S 316. M 345.
587 pair.
588 cuff-buttons.
589 snow S 52. M 51.
590 overcoat S 583.
591 pie S 376.
592 robe S 668.

593 wall S 485. M 404.
594 chatter-box.
595 A, B, C.
596 bears.
597 babies.
598 Bye-low S 390.
599 Beggars-come-to-town.
600 Billy.
601 blinds S 43. M 155.
602 boys.
603 Brownie-brother. M 262.
604 butterfly.
605 buttons.
606 button-hook. M 153.
607 care S 437. M 449.
608 cars.
609 cough-medicine.
610 cold. M 242.
611 dinner-bell.
612 dogs.
613 drawers.
614 food S 233.
615 finger-nails.
616 Georgy-Porgy.
617 glasses. M 180.
618 gray-table.
619 hair-ribbon S 125. M 88.
620 hassock S 68. M 432.
621 handle S 520. M 298.
622 H. Gale.
623 Jack and Jill.
624 John S 152.
625 lemonade.
626 letter-paper-box.

2, S. Boy.
Mo. 27 to 28.
track
decoration
robin-red-breast
row
carpet-cleaner
peach
grapes. M 396
bobolink
blind-man's-buff
Grossvater
family
Van Dusen
middle. M 366
newel-post
turn
powder
plumber
Friday
Saturday
driveway
coal-man
tent
tapioca-pudding.
check-rein
rose
end. M 418
fur
couple
ding-bell
father
jelly. M 76
taste
hugerei
milk-man. M 371

3, H. Girl.

627 monkey-man S 234.
628 paints.
629 pee-pee-place.
630 pincushion.
631 rags.
632 rocking-horse S 120. M 299.
633 screws.
634 sewing-basket S 494.
635 shirts.
636 sled.
637 soaps.
638 spoons.
639 stones S 775.
640 "Süsse Ruh, Augen Zu."
641 Tilly.
642 tip-toes.
643 times.
644 3, 4, Jack.
645 wash rag.
646 water-closet S 488. M 330.
647 words.

3, H. Girl.

Mo 28 to 31.

648 Aunt Kate's.
649 birthday-cake.
650 day S 480.
651 drinking-water.
652 foot-ball.
653 front-chamber.
654 Goodrich's house.
655 H. G. [deutsch].
656 lines.
657 lunch S 323.
658 men S 577.
659 Richard.
660 shadow. M 414.
661 sugar-bowl.
662 tooth-powder.
663 tooth-picks.
663 turkey.
664 tassle-cap.
665 edge S 557.
666 nut S 131.
667 veil S 94. M 125.
668 card-board.
669 stamps S 720.
670 body S 332.
671 crayons.
672 donkey S 669.
673 Wesley.
674 star
675 sachet.
676 lace S 729. M 286.
677 cocoanut.
678 Silly-Billy.
679 dollar. M 281.
680 drug-store S 454.
681 grocery-store. M 400.

2, S. Boy.

Mo. 28.

pantaloons
gas-heater
sun-fish
lip
alligator
bank
morning. M 336
woman. M 8
Männlein
harm
dentist
puppy-dog
hoar-hound
Papagei
Haut
oil-cloth
pound
plan
cyclone
Turk
Canadian
Chineser
John Bull
dude
Scotchman
Yankee
Indian
Schutzmann
Dutchman
overshoes. M 393
writing paper
safety pins
A. S. M.
toy-man
tower

3, H. Girl.

682 winter.
683 overalls.
684 register S 391. M 284.
685 chapter.
686 Schubert S 434.
687 silk.
688 waste-paper basket S 512. M 328
689 "draw-a-bucket-of-water."
690 bitter-stuff.
691 throat.
692 library S 501.
693 game.
694 popcorn S 569.
695 gristle S 532.
696 watering-pot.
697 Brahms.
698 Beethoven S 770.
699 trunk.
700 note S 378. M 378.
701 tray.
702 ink-bottle.
703 butcher-shop. M 399.
704 ironing-board.

3, H. Girl.

705 spool S 108. M 109.
706 Mrs. Belknap.
707 roguey-poguey.
708 pencil sharpener.
709 cough-syrup.
710 guimpe.
711 Frosch.
712 half-an-hour.
713 Jungle-book.
714 Brownie-book S 348. M 271.
715 jelly-roll.
716 broth.
717 top S 452.
718 plaything.
719 scrap-book.
720 Henry.
721 pony-cart.
722 Billy-Smart.
723 picture-frame.
724 sign.
725 angel-cake.
726 Hiawatha-baby.
727 Miss Haversham.

2, S. Boy.

Mo. 29.

728 David Copperfield. fire-alarm-key
729 carpet-sweeper S 111. Unitarian Church
730 well. juice
731 starch-box S 595. Vine-Place
732 club. lion. M 310
733 secret. parade
734 suit. sled
735 counters. page
736 magazines. rest
737 castle. baking-powder can
738 roof S 666. year
739 cupola. pyramid
740 muff S 604. M 386. dandruff
741 crumbs S 238. railing
742 cotton S 298. seed
743 pill S 14. advertisement
744 flat-iron S 335. arm-hole
745 pattern S 634. breast
746 Emma. scales
747 Thomas-Orchestra. chest. M 339
748 village. mischief
749 kettle. word
750 brick-house. drawing-pencil
751 calendar. M 397. Fiedelbogen
752 pantry S 530. M 438. side-comb
753 button-hole. M 430. girls
754 blanket S 621. M 118. lamp-chimney
755 stripes. grape
756 number. Toby
757 golden-glass. mosquitoes
758 gold-bracelet. jelly-glass
759 Hale's store. hash
760 tickle-oil. Harlow
761 concert. Corser. M 265
762 trochee-box. Elwood
763 peeling. fountain-house

3, H. Girl.

764 mat S 581.
765 nursing-bottle.
766 butter-knife.
767 butter-dish.
768 Mr. Fuge.
769 jointed-doll.
770 bastings.
771 new-bottom-chair.
772 joke S 251.
773 macaroni S 667. M 349.
774 screw-driver S 795.
775 vinegar.
776 part S 551.
777 trouble.
778 croutons.
779 valentine.
780 valentines.
781 tears S 206.
782 landing.
783 custard S 191.
784 leggings S 143.

3, H. Girl.

785 people S 619. M 439.
786 grease.
787 button-hole scissors.
788 little-Helen.
789 shirt S 274.
790 sapolio. M 326.
791 hunk.
792 sawdust.
793 speck.
794 buckle.
795 pillars S 642.
796 smoke-stack S 690.
797 slop-drain.
798 blackbird.
799 ounces.
800 whisk-broom S 529.
801 satchel.
802 Holy-Bible.
803 stain.
804 devil-show.

2, S Boy.

Mo. 30.

805 conservatory S 460.
806 door-knob.
807 shoulders S 545. M 315.
808 Chicago.
809 elevator. S 615.
810 Little Dorrit.
811 pansies.
812 ornament S 751.
813 fruit-dish.
814 false-teeth.
815 Dr. Roberts.
816 union-suit.
817 dessert S 625.
818 "alles-blau."
819 "alles-roth."
820 apron-strings.
821 baby-carriage.
822 baby's.
823 back S 119. M 140.
824 baby-boy.
825 bed-spread S 575. M 249.
826 blocks S 703.
827 bossy-cow.
828 bottle S 322.
829 boy's.
830 bows.
831 books.
832 Brownies.
833 bureau-drawer.
834 Cacao.
835 card. M 161.
836 chairs.
837 clothes-bars.
838 color.
839 crayon.
840 crochet-bonnet.
841 crochet-reins.
842 cups S 700.

Germany
alcohol. M 373
summer
tramp
peg
fever
skate
Bismarck
Napoleon
blotting-paper
roast-beef
post
chunk
door-bell
hypo
bean-stalk
set
cornucopia
Golliwog
Hinz-Hans-Heinz-book
Uncle William-book
Water-baby-book
Struwelpeter-book. M 273
midget
humbug
rogue
lots
magnifying-glass
half
Tom
ginger-cake
peanut-shell
hedge-hog
Mamie
leopard
mistake
tag
slant

	3, H. Girl.	2, S. Boy.
843	disk.	fish-hook
844	Deckes.	celery
845	Dick's.	stone-wagon
846	Dicksie's.	weight
847	dinner-table.	Walter Baldwin
848	doll-Helen.	school-book
849	dolls.	cubes
850	dollars.	arches
851	doll's.	pie-pudding
852	Emma's.	Christenson
853	faucets S 456.	Paulinchen
854	fires.	Kohlpechrabenschwarzermohr
855	flowers.	crow-birdy-book
856	fork S 160. M 44.	crow
857	freckles.	Sarah Jane
858	Hilsie's.	flute
859	horses.	dapple-grey
860	holes.	toys
861	jug-water S 498.	fairy-lamp
862	kitty-book.	repose
863	kittens.	Golliwog-book
864	light.	water-baby
865	Mama's.	water-book
866	mats.	Carroll
867	May S 126.	Roberts
868	May's	kite
869	monies.	
870	name S 416.	
871	Nettie's.	
872	newspaper.	
873	pad-paper.	
874	Papa's.	
875	penny-doll.	
876	pieces S 778.	
877	pennies.	
878	pictures S 537.	
879	playthings.	
880	plates.	
881	Popsie's.	
882	policeman S 422. M 434.	
883	red-rocking-chair.	
884	reins S 154. M 428.	
885	"Rock-a-bye-Baby."	
886	rubber-chicken.	
887	rugs.	
888	Samsie's.	
889	Sammy's.	
890	sewing-bag.	
891	sideboard S 169. M 410.	
892	sleeves.	
893	slop-jar S 433.	
894	sleigh-bells.	
895	stone-blocks S 177.	
896	string S 137. M 103.	
897	steamer.	
898	tea-kettle S 476. M 320.	
899	telescope-bag.	
900	thing S 324.	
901	thumb S 562. M 359.	
902	tin-pan.	
903	trees.	
904	Van Dusen's-house.	

VERBS.

3, H. Girl.	2, S. Boy.	1, M. Girl.
Mo. 17.	Mo. 17.	
1 burn S 11.	bye low	
2 see S 60. M 4.	hug. M 100	
3 take S 17. M 13.		
4 want S 142. M 45.		
Mo. 18.		
5 blow S 23.		
Mo. 19.	Mo. 19 to 23.	To Mo. 24.
6 eat S 62. M 21.	choke. M 56	scratch
7 wash S 125. M 8.	turnen	
8 ride S 90. M 22.	bring	
9 pat. M 52.	harness	
10 write S 131. M 35.		
11 bump S 24. M 126.		
12 pee-pee S 117. M 83.		
13 fix S 55. M 16.		
Mo. 20.		
14 bark S 91.		
15 cut S 1. M 64.		
16 rock S 35. M 1.		
17 ring S 111. M 54.		
18 patty-cake.		
19 open S 18.		
20 read S 102. M 17.		
21 tie S 48. M 24.		
22 touch S 54. M 84.		
23 dance S 12. M 19.		
24 fall S 85. M 40.		
25 cough S 67.		
26 find S 58. M 15.		
27 tickle S 49. M 5.		
28 walk S 39. M 2.		
Mo. 21.		
29 reach S 136.		
30 sing. S 53. M 51.		
31 swing S 80. M 30.		
32 carry S 20. M 66.		
33 mache was S 4. M 60.		
34 pound S 7. M 14.		
35 paint.		
36 empty S 51.		
37 roll S 44. M 6.		
38 play S 30. M 10.		
39 button S 147 M 139.		
40 go S 5. M 3.		
41 hold S 75. M 43.		
42 point S 116.		
43 throw S 40. M 34.		
44 build.		
45 fold S 59. M 130.		
46 call. M 29.		
47 spill S 103. M 106.		
48 catch S 96. M 105.		
49 run S 105. M 44.		
50 milk S 98.		
51 sweep S 22. M 33.		
52 tease.		
53 taste S 107. M 88.		

3, H. Girl.

54 suck S 70. M 94.
55 cook S 303.
56 come S 9.
57 like S 224.
58 tick.
59 don't.
60 dig S 159.
61 dress S 173.
62 hurt S 88. M 61.
63 prick S 8. M 57.
64 rain.
65 shut S 45. M 53.
66 sit S 61. M 71.
67 do S 154.

Mo. 22.

68 sneeze S 213.
69 pick S 3. M 32.
70 tuck S 171. M 107.
71 cuddle.
72 help S 76. M 41.
73 kiss S 28.
74 stick.

Mo. 23.

98 has S 307.
99 hammer.
100 sail.
101 whip.
102 wipe S 65. M 59.
103 made S 163.
104 did S 169. M 115.
105 now S 238.
106 push S 167. M 58.
107 grunt S 221.
108 saw S 254. M 69.
109 show S 42. M 63.
110 love S 79. M 101.
111 stand S 56. M 39.
112 pull S 38.
113 wave S 134.
114 shoot S 99.
115 climb S 72.
116 crawl S 278.
117 that's.
118 stay S 77.
119 lift S 115. M 145.
120 disturb S 236.
121 turn S 89. M 62.
122 shake S 52. M 72.
123 step S 240.
124 feel S 140.
125 finish S 130.
126 comb S 157.
127 drink S 92. M 18.
128 pinch S 126. M 65.
129 put S 2. M 55.
130 say S 170. M 143.
131 wheel S 114.

3, H. Girl.

75 fly S 188.
76 cover S 21. M 31.
77 smell S 32. M 38.
78 rub S 113.
79 tumble S 160. M 73.
80 move S 57.
81 look S 101. M 76.
82 kick S 26. M 148.
83 mend S 31. M 67.
84 watch S 120. M 11.
85 get S 152. M 9.
86 jump S 156.
87 slide S 100. M 103.
88 hang S 41. M 75.
89 march S 14.
90 wear.
91 splash S 63. M 80.
92 brush S 158.
93 change S 93. M 79.
94 hide S 10.
95 make S 46. M 7.
96 pin S 37.
97 sleep S 161. M 28.

2, S. Boy.

Mo. 23.

hurry M 104
hitch
meet
shovel
paste

3, H. Girl.		2, S. Boy.
Mo. 24.		Mo. 24.
132	draw S 277. M 82.	creep
133	fight.	wiggle
134	listen. M 95.	unbutton
135	mail.	iron
136	poke S 43.	bounce
137	stop S 50.	moo
138	need S 153.	head
139	hop S 47.	
140	scrub S 132. M 135.	
141	shine S 247. M 133.	
142	toss.	
143	lie S 155. M 74.	
144	sew S 36. M 26.	
145	hit S 66.	
146	wrap S 73.	
147	scour.	
148	buy S 277. M 50.	
149	kill.	
150	tip S 64.	
151	squeeze S 204.	
152	surprise.	
153	talk S 95. M 48.	
154	beat.	
155	water.	
156	swim S 267.	
157	bite S 13. M 37.	
158	can't S 168.	
159	drop S 162. M 12.	

			1, M Girl.
Mo. 25 to 28.		Mo. 25 to 28.	Mo. 25 to 31.
160	ask S 172.	clap	squeal
161	comes.	pile	hand
162	does S 308. M 114.	leak	smoke
163	goes.	blind	knit
164	hunt S 108. M 149.	rinse	kitzeln
165	see-saw.	ring-around	bathe
166	slip S 228.	pump. M 119	meant
167	tanz	whistle. M 87	hallo
168	untie.	frighten	paddy-wax
169	wait S 106. M 77.	whisper	kindle
170	went. S 266.	scream	melt
171	wet S 33.	could	dust
172	came S 274.	caught	rest
173	be S 200. M 90.	slept	
174	drive S 94. M 23.	been	
175	spank S 27. M 128.	speak	
176	build S 34. M 137.	swallow	
177	pour S 69.	dump	
178	set. M 132.	bust	
179	tell S 146. M 144.	sprinkle	
180	remember S 299.	said	
181	must S 227. M 111.	work. M 116	
182	muss S 129.	was. M 92	
183	wind. M 36.	send	
184	fill S 220. M 136.	nurse	
185	mean S 144.	mind	
186	feed S 83. M 141.	begin	
187	count S 145.	wonder	
188	knock S 16.	wade	

	3, H. Girl.	2, S. Boy.
189	fasten S 127. M 138.	took
190	leave S 135.	strip
191	clean S 164.	would
192	light S 214. M 78.	aren't
193	cry.	chop
194	laugh S 212. M 42.	
195	enjoy.	
196	chop S 250.	
197	pack. M 129.	
198	twist.	
199	fit. M 140.	
200	think S 181.	
201	measure. M 102.	
202	dream S 124.	
203	vomit.	
204	bother.	
205	attend S 235. M 117.	
206	keep S 84.	
207	lock S 78.	
208	stir.	
209	hear S 123. M 27.	
210	spit S 138. M 147.	
211	lean S 218.	
212	is S 197. M 91.	
213	rest S 143.	
214	rattle.	
215	show.	
216	sharpen.	
217	kneel.	
218	guess S 226. M 93.	
219	slap.	
220	spill S 283. M 89.	
221	won't S 194. M 113.	
222	cool S 229.	
223	erase.	
224	crochet. M 96.	
225	can. M 110.	
226	give S 128. M 70.	
227	glue.	
228	got S 310.	
229	have S 81. M 47.	
230	isn't S 198.	
231	lose.	
232	telephone.	
233	thread S 261.	
234	tore.	
235	try. M 49.	
36	undress S 245.	
237	unpin.	
238	warm S 82.	
	Mo. 28 to 31.	Mo. 28.
239	are S 216.	whipped
240	grab.	drove
241	know S 180.	ache
242	lost.	decorate
243	mustnt?	jerk
244	trot S 246. M 20.	tipped
245	slam S 260.	wanted
246	ought S 301.	screw
247	mash.	float

3, H. Girl.

248 freeze S 232.
249 left.
250 chase S 284.
251 jiggle.
252 tunk.
253 spin.
254 pass S 182.
255 boil. M 98.
256 bake S 304.
257 untangle.
258 string.
259 start.
260 press.
261 live S 174.
262 had S 271. M 68.
263 gets
264 smile.
265 fell S 248.
266 nip.
267 knit.
268 belong S 176. M 108.
269 race.
270 trade.
271 color.
272 hope.
273 aches.
274 snap S 29.
275 borrow.
276 told S 258.
277 need.
278 shall S 139. M 124.
279 spatter.
280 squeak S 205.
281 bother.
282 wish S 237.
283 wrote.
284 cross.
285 heard.
286 coast.
287 vaccinate.
288 break.
289 brought S 251. M 46.
290 didn't S 241.
291 fasten.
292 gave.
293 headerei.
294 heard.
295 hurts.
296 let S 109.
297 looks.
298 shan't.
299 spread S 239.
300 straighten.
301 tear S 71.
302 use S 243.
303 undo.
304 wake S 87. M 81.
305 will S 186. M 112.
306 wiped.
307 washed S 273.

2, S. Boy.

Mo. 28—Continued.

visit
ran
jingle
sent
were
weren't
snuggle
stuck
care
save
forgot
used
thought
bought
finished
drag
skate

clear. M 131
punch
collapse
print
"be-reposed"
squirt
slop. M 127
drip
scrape
stayed
wag
dropped
spend
suppose
grease
shan't
tangle

ADJECTIVES.

3, H. Girl.

Mo. 15.
1 pretty S 41. M. 1.

Mo. 16.
2 hot S 6. M 26.

Mo. 18.
3 dirty S 79. M 14.
4 warm S 34. M 27.
5 broken S 4. M 2.

Mo. 19.
6 (all) gone S 10. M 3.
7 wet S 75. M 12.

Mo. 20.
8 dark. M 58.
9 clean S 44. M 10.
10 sticky S 88. M 93.
11 bad S 26.
12 another S 7. M 16.
13 awake S 96.
14 more S 2. M 34.

Mo. 21.
15 nasty.
16 good S 32. M 23.
17 asleep S 22.
18 sorry S 115.
19 shut.
20 through S 66. M 29.
21 nice S 8. M 8.
22 ready S 33. M 17.
23 still S 84. M 74.

Mo. 22.
24 enough S 3. M 40.
25 heavy S 13. M 104.
26 hard S 43. M 90.
27 naughty S 24. M 15.
28 one S 20. M 63.
29 caught.
30 thirsty.
31 lost S 146. M 102.

Mo. 23.
32 cold S 9. M 5.
33 dear S 42. M 4.
34 happy S 126. M 59.
35 horrid. M 62.
36 right S 47. M 97.
37 torn S 103. M 11.
38 sunny S 139.
39 crooked S 109. M 73.
40 straight.
41 cute S 68. M 95.
42 long S 51. M 88.

2, S. Boy.

To Mo. 23.
tired M 21.
big M 9.
several.
dead.

2, S. Boy.

Mo. 23.
black. M 47.
gingham. M 76.

1, M. Girl.

To Mo. 24.
open.

3, H. Girl.

43 large S 98.
44 new S 23. M 31.
45 pink S 73. M 51.
46 bare S 45. M 30.
47 comfortable S 106. M 87.
48 poor S 11. M 25.
49 cross.
50 süsse.

3, H. Girl.

51 liebe.
52 little S 60.
53 sick S 15. M 43.
54 sore S 12. M 85.
55 blessed.
56 high S 16. M 22.
57 other S 69.

Mo. 24.

58 coming. M 18.
59 funny S 61. M 96.
60 two S 55. M 33.
61 best S 160.
62 precious. M 101.
63 fine.
64 fat. M 28.
65 first.
66 sharp S 158. M 61.
67 last S 100.
68 sweet S 65. M 38.
69 silly.
70 tight. M 20.
71 wrong S 162. M 98.
72 both S 80. M 32.
73 no S 28.
74 large. M 103.

2, S. Boy.

Mo. 24 to 25.

glad. M 56
wee. M 99
six. M 67.
round
doubled-up
sixteen
undone
lazy

1, M. Girl.

flannel

Mo. 25 to 28.

75 barefoot.
76 all S 56. M 39.
77 beautiful S 112. M 80.
78 blue S 58. M 49.
79 four S 116. M 65.
80 eleven.
81 old S 85.
82 six years old.
83 soft S 151. M 89.
84 ten S 138. M 71.
85 three S 137. M 64.
86 near. M 91.
87 tiny S 40.
88 yellow. M 48.
89 dressed.
90 well S 135.
91 lovely. M 81.
92 dry S 50. M 13.
93 like S 87. M 84.
94 taken.
95 farther. M 92.
96 own S 17.
97 else S 145.
98 bottom.
99 full S 49.
100 small S 159.
101 white S 30. M 46.
102 graham.
103 many S 27. M 45.
104 gay.
105 next S 148.

Mo. 25 to 28.

brown. M 53
sleepy. M 55
sour
gray
greasy. M 94
left
bright
alle
real
salty
every
soapy
hungry. M 60
smooth
far
great
getting

Mo. 25 to 31.

being
fussy
golden
twelve
hiding
mussed
silk
ka-ka
ashamed
older
homely
afraid

3, H. Girl.

106 afraid S 18.
107 front S 64.
108 such S 140.
109 fresh.
110 whole S 57.
111 better S 141. M 82.
112 silly.
113 any S 48. M 24.
114 baked.
115 loose S 81.
116 late.

3, H. Girl.

117 curly S 101.
118 green S 54. M 52.
119 mended.
120 much S 92. M 44.
121 raining.
122 silver S 152.
123 undressed.
124 washed.
125 some S 19. M 42.
126 sliced S 132.

2, S. Boy.

Mo. 28 to 31.

127 low S 125.
128 swept.
129 woolen. M 75.
130 uncovered.
131 safe.
132 tall S 143.
133 few S 74.
134 brand-new.
135 soiled.
136 fertig
137 sure S 149. M 83.
138 blondes.
139 strong S 144.
140 queer
141 young.
142 red S 29. M 50.
143 busy S 91.
144 going S 99. M 19.
145 purple.
146 alone S 86.
147 only.
148 eating.
149 old-fashioned
150 common.
151 cool.
152 careful S 111. M 35.
153 sealed.
154 rough. S 133.
155 rather.
156 dizzy.

Mo. 28 to 31.

worn out.
five. M 66.
seven. M 68.
eight. M 69.
nine. M 70.
trying.
upside down.
half.
striped.
cunning. M 37.
early.
150.
mad.
wide.
gold.
stiff.
each.
same.
decorated.
writing.
seen.
blau.
35.
20.
different.

ADVERBS.

3, H. Girl.

Mo. 16.

1 there S 5. M 2.

Mo. 18.

2 off S 28. M 3.

Mo. 19.

3 away S 2.

2, S. Boy.

Mo. 19 to 23.

down town
out

3, H. Girl.

Mo. 20.

4 back S 1. M 7.
5 up S 6. M 1.
6 quickly S 12. M 6.
7 in S 33.
8 out S 9. M 9.
9 in there.

Mo. 21.

10 no S 4. M 23.
11 fast S 36.
12 down-stairs S 31.
13 up-stairs S 30.
14 out-doors S 10. M 5.
15 close S 32.
16 around S 25. M 19.
17 down S 3. M 17.

Mo. 22.

18 along S 24. M 18.

2, S. Boy.	1, M. Girl.
Mo. 23.	Mo. 23.
near	bye and bye
	hardly

Mo. 23.

19 now S 11. M 11.
20 of course. M 21.
21 too S 15. M 4.
22 where S 26. M 24.
23 again S 16. M 8.
24 horse-back S 22.
25 yes. M 22.
26 on S 29.

3, H. Girl.	2, S Boy.	1, M. Girl.
Mo. 24.	Mo. 24.	Mo. 24.
far.	wide	then
here S 7. M 3.	tip toe	
over S 19.	more	
tomorrow S 54.	tight	
after S 60. M 28.	clear	
Mo. 25 to 31.	Mo. 25.	
a pace.	how	
yet. M 25.	when. M 29.	
very S 41. M 14.	badly. M 15.	
much.	steady.	
so S 48.	pretty.	
awfully S 62. M 27.	loud.	
day after tomorrow.		
together S 19.	Mo. 26.	
outside S 58.	better.	
softly	first.	
once S 46.	backward.	
today S 12.	inside.	
before.	maybe.	
not S 75.	Mo. 27.	
perhaps S 49. M 20.	head first.	
afterward.	gently.	
really and truly.	only.	
somewhere S 43.	upside down.	
soon S 53.		

3, H. Girl	2, S. Boy.
Mo. 25 to 31 Continued.	
51 just S 50.	Mo. 28.
52 yesterday S 66.	kind of.
53 why S 34.	night.
54 already S 17.	Mo. 29.
55 least.	apart.
56 almost S 56.	nearly.
57 still.	as.
58 easily.	Mo. 30.
59 ever.	quite M 26.
60 ago.	back and forth.
	about.
	at once.
	never.

INTERJECTIONS.

3, H. Girl.	
Mo. 15.	
1 Goodbye S 1.	
Mo. 16.	2, S. Boy.
2 Hurrah S 6.	To Mo. 19.
3 bye-low.	get-up.
4 peek-a-boo S 4. M 5.	
Mo. 19.	Mo. 19 to 23.
5 Hark.	Hurrah.
Mo. 20.	shame.
6 bow-wow.	whoa.
7 cock-a-doodle-doo.	
8 mew.	
Mo. 21.	
9 Good-night S 3. M 4.	
10 Gute Nacht.	
11 thank you.	
12 ouch S 13.	
13 rock-a-bye.	
14 please S 8. M 6.	
Mo. 22.	
15 chu-chu.	
16 toss-in-the-oven.	
Mo. 23.	Mo. 23 to 25.
17 a-ho.	look out.
18 oh S 15.	back.
19 mercy-sakes S 24.	Danke M 2.
20 swing-swong S 12.	
Mo. 24.	
21 ah.	
22 a-ha.	
23 adieu.	
24 hello S 18.	
25 Good-morning S 19.	
26 ding-dong.	
27 see-saw S 11.	

3, H. Girl.	2, S. Boy.	1, M. Girl.
Mo. 25 to 31.	Mo. 25 to 31.	Mo. 25 to 31.
28 creep-a-mouse.	Guten-Morgen.	Auf-wiedersehen.
29 How-do-you-do? S 10. M 1.	Good-evening.	
30 Hurrah, sound-the-jubilee.	Guten-Abend.	
31 ring-'round-the-mulberry-bush.	Oh my M 3.	
32 trot-trot-trot.	all-aboard.	
33 dear me.	hah.	
34 excuse me.	ding-a-ling.	
35 ho.		
36 hush S 17. M 8.		

PRONOUNS.

3, H. Girl.	2, S. Boy.	1, M. Girl.
Mo. 22.		
1 that S 1.		
2 this S 20.		
Mo. 23.		
3 self S 4.		
4 my S 9.		
	2, S. Boy.	
Mo. 24.	Mo. 24.	
5 me S 2. M 17.	ownself.	
6 what S 6. M 16.	mine M 4.	
	anything.	
	somebody M 8.	
	it M 5.	
		1, M. Girl.
Mo. 25 to 28.	Mo. 22.	Mo. 25 to 31.
7 I S 17. M 1.	which M 6.	anybody.
8 one S 7. M 2.	his M 13.	everybody.
9 those S 21.	these.	their.
10 she S 23. M 20.		
11 something S 5. M 7.		
12 her S 35. M 14.		
13 herself.		
14 you S 28. M 11.		
Mo. 28 to 31.	Mo. 28.	
15 who S 14.	we	
16 everything S 22.	us.	
17 own M 3.	Mo. 29.	
	our M 18.	
	ourselves.	
	they.	
	Mo. 30.	
	him.	
	whose.	
	them.	
	your M 12.	
	he M 19.	

PREPOSITIONS.

3, H. Girl.

Mo. 23.
1 in S 2. M 1.
2 over S 21.
3 through S 9.
4 for S 12. M 6.

Mo. 24.
5 under S 4. M 5.

Mo. 25 to 31.
6 about S 3. M 8.
7 across S 10.
8 with S 13.
9 without.
10 of S 6. M 10.
11 from S 19.
12 against S 18. M 9.
13 on S 1. M 4.
14 to S 20.
15 behind S 5. M 7.
16 by S 25. M 11.

2, S. Boy.

Mo. 24.
out M 2.
up.

Mo. 25.
between.
beside.
around.
upon.

Mo. 27.
at.
except.

Mo. 28.
since.

Mo. 30.
into.

CONJUNCTIONS.

3, H. Girl.

Mo. 25 to 28.
because S 1. M 3.
before S 10. M 2.

Mo. 28 to 31.
and S 3. M 1.

2, S. Boy.

Mo. 27.
while.

Mo. 29.
but
if M 4.
then.
as.

Mo. 30.
so.
until.
or.

1, M. Girl.

Mo. 25 to 31.
either.

ARTICLES.

3, H. Girl.

Mo. 28.
the S 1.

2, S. Boy.

Mo. 29.
a

As the first point of interest in these vocabularies is the figures resulting from them we give for each child separately the total number of words used up to each month or period of months, together with the percentage of growth during each period in the accompanying Tables I and II.

OBSERVER	EXPOSURE			AL EXPOSURES			
	RW.	IW.	RC.	V.	RC.	IC.	O.
Horton.....	45	2	24	29	143	53	8
Holmes.....	23	9	34	32	126	42	20
Brill.....	15	5	20	25	87	44	11
Mills.....	26	2	20	13	81	41	25
Male Totals..	109	18	98	99	437	180	64
—McGregor.....	28	3	33	28	120	78	12
—Hooker..... ...	23	1	19	27	94	95	21
—Donaldson.....	32	4	18	29	85	82	9
—Evans.....	30	1	35	37	110	104	30
Female Totals	113	9	105	21	409	359	72
Male and Female Totals	222	27	203	20	846	539	136

	MALE TO
Rw.	764.....51.6
Iw.	99..... 6.7
Rc.	437.....30.
Ic.	180.....12.1

OBSERVER	EXPOSURE			AL EXPOSURES.			
	RW.	IW.	RC.	W.	RC.	IC.	O.
Horton							
Holmes							
Norton.							
Dixon..							
4 Mal							
Carlson							
Gale.....							
Male							
Hooker							
Donalds							
McGreg							
Evans...							
Femal							
Male a							
Femal							

TABLE I. SERIES A.

OBSERVER	EXPOSURE I.					EXPOSURE II.					EXPOSURE III.					EXPOSURE IV.					EXPOSURE V.					TOTAL EXPOSURES				
	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.
Horton	45	2	24	22	0	39	4	37	14	1	45	7	32	10	1	52	8	31	2	2	59	8	19	5	4	240	29	143	53	8
Holmes	23	9	34	13	0	27	8	28	12	1	29	5	26	10	7	44	4	20	5	4	43	6	18	2	8	146	32	126	42	20
Brill	15	5	20	18	0	24	4	15	15	0	24	5	21	6	2	30	6	17	2	3	30	5	14	3	6	123	25	87	44	11
Mills	26	2	20	16	0	31	3	19	8	0	30	1	17	8	8	31	5	13	7	8	37	2	12	2	9	155	13	81	41	25
Male Totals	109	18	98	79	0	121	19	99	49	2	128	18	96	34	18	157	23	81	16	17	169	21	63	12	27	764	99	437	180	64
—McGregor	28	3	33	22	0	35	4	28	22	0	45	5	18	17	1	49	6	19	10	3	44	10	22	7	8	201	28	120	78	12
—Hooker	23	1	19	28	0	14	2	27	23	0	21	7	26	17	5	28	6	11	18	8	36	11	11	9	10	122	27	94	95	21
—Donaldson	32	4	18	25	0	33	12	17	16	3	43	3	13	13	3	31	6	22	18	2	49	4	15	10	1	188	29	85	82	9
—Evans	30	1	35	38	0	47	4	25	22	6	37	8	18	17	4	52	14	16	14	8	53	10	16	13	12	239	37	110	104	30
Female Totals	113	9	105	103	0	129	22	97	83	9	146	23	75	64	11	160	32	67	60	21	182	35	64	39	31	650	121	409	359	72
Male and Female Totals	222	27	203	182	0	250	41	196	132	11	274	41	171	98	29	317	55	149	76	38	351	56	127	51	58	1414	220	846	539	136

MALE TOTAL.	FEMALE TOTAL.	TOTALS BOTH.
Rw. 764.....51.6 per cent.	650.....42. per cent.	1414.....46.8 per cent.
Iw. 99..... 6.7 "	121..... 7.8 "	220..... 7.2 "
Rc. 437.....30. "	409.....26.5 "	846.....28. "
Ic. 180.....12.1 "	359.....23.3 "	539.....17.8 "

TABLE II. SERIES B.

OBSERVER	EXPOSURE I.					EXPOSURE II.					EXPOSURE III.					EXPOSURE IV.					EXPOSURE V.					TOTAL EXPOSURES.				
	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.	RW.	IW.	RC.	IC.	O.
Horton	34	6	8	12	0	31	8	8	12	1	28	6	9	16	1	30	7	8	13	2	34	4	9	8	5	157	31	42	61	9
Holmes	14	15	18	13	0	28	5	15	12	0	26	2	14	16	2	25	5	13	16	1	39	1	10	7	3	132	28	70	64	6
Norton	32	20	4	4	0	46	6	4	3	1	34	9	7	6	4	41	11	3	5	0	43	6	3	6	2	196	52	21	24	7
Dixon	25	16	10	8	1	30	10	7	13	0	42	5	5	7	1	42	4	4	7	3	43	6	7	2	2	182	41	33	37	7
4 Male Totals	105	57	40	37	1	135	29	34	40	2	130	22	35	45	8	138	37	28	41	6	159	17	29	23	12	667	152	166	186	29
Carlson	17	1	16	26	0	20	5	18	12	5	25	6	8	14	7	27	3	13	10	7	33	5	6	9	7	122	28	61	71	26
Gale	14	9	21	16	0	21	7	16	15	1	25	3	11	14	7	36	3	7	7	7	14	5	2	3	9	137	29	57	55	24
Male Totals	136	67	97	79	1	176	41	68	67	8	180	31	54	73	22	201	43	48	58	20	206	27	37	35	28	926	201	284	312	79
Hooker	18	2	20	20	0	18	5	18	18	1	15	8	20	12	5	22	5	13	15	5	31	4	9	13	3	104	24	80	78	14
Donaldson	29	9	12	10	0	30	7	14	9	0	31	3	9	16	1	35	5	11	7	2	44	8	5	3	2	169	32	49	45	5
McGregor	18	2	23	17	0	25	6	12	16	1	23	10	12	15	0	30	8	13	9	0	38	3	8	9	2	134	29	68	66	3
Evans	25	12	17	6	0	23	10	15	10	2	26	3	8	20	3	36	5	9	8	2	36	7	3	11	3	146	37	52	55	10
Female Totals	90	25	72	53	0	96	28	59	53	4	95	24	47	63	9	123	23	46	39	9	149	22	25	36	10	553	122	249	244	32
Male and Female Totals	226	92	149	132	1	272	69	127	120	12	275	55	103	136	31	324	56	54	97	29	382	49	60	71	38	1479	323	533	556	111

4 MALES.	6 MALES.	FEMALES.	TOTALS.
Rw. 667.....57 per cent.	926.....53.7 per cent.	553.....47. per cent.	1476.....51. per cent.
Iw. 152.....13 "	201.....11.6 "	122.....10.5 "	323.....11. "
Rc. 166.....14 "	284.....16.5 "	249.....21. "	533.....18.4 "
Ic. 186.....16 "	312.....18.1 "	244.....20.5 "	556.....19.4 "

TABLE III. PAGES 1, 3, 5 and 10 OF SERIES B.

OBSERVER	EXPOSURE I.				EXPOSURE II.				EXPOSURE III.				EXPOSURE IV.				EXPOSURE V.				TOTALS.			
	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.	RW.	IW.	RC.	IC.
Horton	6	5	3	6	9	8	2	1	10	3	3	3	9	4	2	4	11	2	1	3	45	22	11	17
Holmes	2	10	5	3	6	3	5	6	10	2	4	2	10	4	3	5	16	1	1	1	44	20	18	17
Norton	6	6	2	3	13	3	2	2	9	5	2	2	14	5	0	1	14	5	0	0	56	27	6	8
Dixon	4	11	2	2	6	7	2	5	15	3	1	1	13	1	0	3	16	2	1	0	54	24	6	11
4 Male Totals	18	35	12	14	34	21	11	14	44	13	10	8	46	14	5	13	57	10	3	4	199	93	41	53
Carlson	6	2	5	7	9	4	3	1	6	7	0	3	12	3	2	3	10	1	2	3	43	17	12	17
Gale	3	8	5	4	9	6	7	1	11	2	1	2	14	3	1	0	14	2	0	1	46	21	14	8
Male Totals	27	45	22	25	47	31	21	16	61	22	11	13	72	20	8	16	81	13	5	8	288	131	67	78
—Hooker	7	2	4	7	6	5	4	5	5	5	5	3	12	3	1	2	14	2	2	1	44	17	16	18
—Donaldson	9	6	2	3	12	4	2	4	14	2	1	3	13	5	2	0	13	3	2	1	61	20	9	11
—McGregor	5	1	8	6	13	4	2	3	4	9	4	3	10	4	3	3	15	3	1	1	47	21	18	16
—Evans	6	9	4	1	7	9	3	0	10	1	0	7	15	3	1	1	14	4	0	3	52	25	8	12
Female Totals	27	18	18	17	38	22	11	12	33	17	10	16	50	15	7	6	56	11	5	6	204	83	51	57
Male and Female Totals	54	63	40	42	85	53	32	28	94	39	21	29	122	35	15	22	137	24	10	14	492	214	118	135

4 MALES.	6 MALES.	FEMALES.	TOTALS.
Rw. 199..... 51.6 %	288..... .....51. %	204.....51.6 %	492.....51.2 %
Iw. 93.....24.1 "	131.....23.2 "	83.....21. "	214.....22.3 "
Rc. 41.....10.6 "	67.....11.8 "	51.....12.9 "	118.....12.3 "
Ic. 53.....13.7 "	78.....13.8 "	57.....13.3 "	135.....14. "

age of Growth.

Parts of Speech per cent.	Month 27.	Increase per cent.	Month 30.	Increase per cent.	Parts of Speech per cent.
59.	651	60.2	911	39.9	60.3
21.5	239	22.3	308	25.	20.4
9.9	126	14.7	156	10.9	10.3
4.	.....	.....	62	22.4	4.
3.6	.....	2.3	36	13.	2.3
0.8	14	.....	17	1.1	1.
0.6	.....	.....	16	5.8	1.
.....	2	.6	3	.3	.....
.....	1032	39.4	1509	46.2	.....

TABLE I.

Total Vocabulary of 3rd Child (H. Girl) at End of Month and Percentage of Growth.

	Month 15.	Month 16.	In crease per cent.	Month 17.	In-crease per cent.	Month 18.	In-crease per cent.	Month 19.	In-crease per cent.	Month 20.	In-crease per cent.	Month 21.	In-crease per cent.	Month 22.	In-crease per cent.	Month 23.	In-crease per cent.	Month 24.	In-crease per cent.	Parts of Speech per cent.	Month 27.	In-crease per cent.	Month 30.	In crease per cent.	Parts of Speech per cent
Nouns	2	2	.....	7	55.5	17	66.6	55	76.	145	74.3	248	62.4	301	55.1	369	46.2	438	53.5	59.	651	60.2	911	39.9	60.3
Verbs	.....	.....	.....	4	44.4	5	6.6	13	16.	28	12.4	67	23.6	97	31.2	132	23.8	160	21.7	21.5	239	22.3	308	25.	20.4
Adjectives	1	2	20.	2	.....	5	20.	7	4.	14	6.	23	5.4	31	8.3	57	17.7	74	13.2	9.9	126	14.7	156	10.9	10.3
Adverbs	.....	1	20.	1	.....	2	6.6	3	2	9	5.	17	4.8	18	1.	26	5.4	31	3.8	4.	.....	.....	62	22.4	4.
Interjectives	1	4	60.	4	.....	4	.....	5	2.	8	2.4	14	3.6	16	2.	20	2.7	27	5.4	3.6	.....	2.3	36	13.	2.3
Pronouns	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2.	4	1.3	6	1.5	0.8	14	.....	17	1.1	1.
Prepositions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2.7	5	.7	0.6	.....	.....	16	5.8	1.
Conjunctions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.6	3	.3	.....
Totals	4	9	125.	18	100.	51	183.	83	62.7	204	145.	369	80.	465	26.	612	31.6	741	21.	.....	1032	39.4	1509	46.2	.....

TABLE II.

Total Vocabulary of 2nd Child (S. Boy) at End of Month and Percentage of Growth.

Vocabulary of 1st Child (M. Girl) at End of Month

	Month 18.	Month 22.	In-crease per cent.	Month 23.	In-crease per cent.	Month 24.	In-crease per cent.	Parts of Speech per cent.	Month 25.	In-crease per cent.	Month 26.	In-crease per cent.	Month 27.	In-crease per cent.	Month 28.	In-crease per cent.	Month 29.	In-crease per cent.	Month 30.	In-crease per cent.	Parts of Speech per cent.	Month 18.	Month 24.	Parts of Speech per cent.	Month 30.	Parts of Speech per cent
Nouns	76	231	5.87	294	52.	416	50.8	57.	498	57.7	550	57.1	607	36.5	663	63.	716	61.6	796	34.3	55.6	31	241	60.2	444	57.7
Verbs	25	102	29.2	131	24.	170	16.2	23.3	207	26.	224	18.7	237	8.3	252	16.8	271	22.1	310	15.5	21.6	4	83	20.7	149	19.3
Adjectives	3	25	8.3	41	13.2	68	11.2	9.3	81	9.2	91	11.	105	9.	120	16.8	131	12.8	153	8.8	10.7	1	37	9.2	103	13.4
Adverbs	4	10	2.3	19	7.4	36	7.	4.9	46	7.	58	13.2	63	3.2	66	3.4	69	3.5	75	2.4	5.2	.....	24	6.	30	3.9
Interjections	5	9	1.5	.....	.....	17	7.	2.3	.....	.....	.....	.....	23	14.7	.....	.....	.....	.....	28	11.2	1.9	.....	5	1.3	8	1.
Pronouns	.....	.....	.....	2	1.6	13	5.	1.7	.....	.....	.....	.....	20	13.	.....	.....	.....	.....	33	13.1	2.3	.....	5	1.3	20	2.5
Prepositions	.....	.....	.....	2	1.6	9	3.	1.2	.....	.....	.....	.....	21	13.5	.....	.....	.....	.....	26	10.3	1.7	.....	5	1.3	10	1.4
Conjunctions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.2	.....	.....	.....	.....	11	4.4	0.7	.....	.....	.....	5	0.6
Total	113	377	23.4	489	29.7	729	49.4	.....	832	14.1	923	10.9	1079	16.9	1101	2.	1187	7.8	1432	20.6	.....	36	400		769	.....

TABLE III.

Vocabulary of Marion Martindell by Months to 2 Years.

	Month 10.	Month 12.	Month 13.	Month 14.	Month 15.	Month 16.	Month 17.	Month 18.	Month 19.	Month 20.	Month 21.	Month 22.	Month 23.	Month 24.	Parts of Speech Per Cent
Nouns	3	9	18	36	54	66	115	180	216	289	412	476	523	555	70.8
Verbs	.....	.....	.....	3	6	7	15	26	35	42	77	84	90	102	13.
Adjectives	.....	1	3	4	7	8	10	16	19	30	42	63	65	69	8.8
Adverbs	.....	.....	.....	3	.....	8	.....	9	11	13	23	26	28	28	3.5
Interjections	.....	.....	1	4	7	.....	11	.....	.....	.....	12	.....	.....	12	1.5
Pronouns	.....	.....	.....	.....	1	.....	.....	2	.....	.....	11	13	.....	13	1.5
Prepositions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	3	4	4	0.5
Total	3	10	22	50	75	89	151	223	281	374	579	665	710	783	.....

TABLE IV. Words Used by 2. B. on

DAY 350, YEAR II. | DAY, 182 YEAR III.

	Different Words. A. M.	Per Cent of A. M. Words	Per Cent A. M. vs P.M. Words	P. M.	Per Cent of P. M. Words	Total	Per Cent Parts of Speech	Vocab. on 350 II.	Vocab. per cent used on 350	Total Words. A. M.	P. M.	All Day.	Per Cent.	Different Words. 1st Period 4½ Hours.	2d Period 4 Hours.	3rd Period 3 Hours.	Total.	Per Cent of Vocab-ulary Used.	Per Cent Parts of Speech	Total Words. 1st Period	2d Period	3rd Period	All Day.	Per Cent.
Nouns	105	44.	51.	99	62.	204	50.	351	58.	1007	1636	2643	51.	219	81	69	369	46.3	47.8	1482	1056	826	3367	36.
Verbs	65	27	65.	35	22.	100	24.	161	62.	407	654	1061	20.	134	37	18	189	60.9	25.	923	765	512	2200	23.6
Adjectives	36	15.	77.	11	7.2	47	11.	57	82.	139	199	338	6.5	43	30	10	83	54.	11.	250	279	200	729	7.8
Adverbs	19	8.	63.	11	7.2	30	7.	33	90.	266	522	788	15.	30	8	4	42	56.	5.5	586	418	310	1314	14.
Interjections	7	3.	70.	3	2.	10	2.5	16	62.	.....	49	49	0.9	5	1	0	6	21.4	0.8	66	30	17	113	1.
Pronouns	5	2.	83.	1	0.7	6	1.	8	75.	39	82	121	2.2	19	4	4	27	81.8	3.	228	209	241	678	7.
Prepositions	6	2.4	75.	2	1.4	8	2.	9	88.	65	129	194	3.8	19	2	0	21	80.7	2.7	203	229	204	636	6.8
Articles	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	0	0	2	.....	.....	21	11	4	36	.....
Conjunctions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	3	1	12	.....	1.5	103	55	59	217	2.3
Total	243	.....	.....	162	.....	405	.....	635	.....	1923	3271	5194	.....	479	166	106	751	.....	.....	3865	3052	2373	9290	.....

TABLE V.

Words used by 3, G. on one day at the beginning of each of the following months, and the percentage of different words used on each day to the entire vocabulary to that day and the percentage of total words among the parts of speech.

	20 MONTH. Different. A. M.	P. M.	T.	Per Cent of Entire Vocab-ulary.	Total. A. M.	P. M.	T.	Parts of Speech Per Cent.	21 MONTH. Different. A. M.	P. M.	T.	Per Cent of Entire Vocab-ulary.	Total. A. M.	P. M.	T.	Parts of Speech Per Cent.	22 MONTH. Different. A. M.	P. M.	T.	Per Cent of Entire Vocab-ulary.	Total. A. M.	P. M.	T.	Parts of Speech Per Cent.	23 MONTH. Different. A. M.	P. M.	T.	Per Cent of Entire Vocab-ulary.	Total. A. M.	P. M.	T.	Parts of Speech Per Cent.
Nouns	41	13	54	98.1	446	570	1016	65.	50	37	87	60.	357	673	1030	79.6	65	37	102	44.1	809	1411	2220	75.7	65	54	119	39.5	1246	1686	2932	66
Verbs	7	6	13	100.	93	245	338	21.6	8	9	27	90.7	45	90	135	9.2	20	19	39	58.2	169	173	342	11.6	30	22	61	62.8	414	504	918	20.8
Adjectives	5	2	7	100.	65	40	105	6.7	1	6	7	50.	1	20	21	1.4	5	1	6	26.1	20	10	30	1.	9	9	18	58.	46	48	94	2.
Adverbs	2	1	3	100.	40	45	85	5.4	4	3	7	77.7	85	165	250	17.1	6	2	8	47.	157	168	325	11.1	8	7	15	83.4	139	128	267	6.
Interjections	2	.....	2	40.	15	4	19	1.2	2	4	6	75.	4	18	22	1.5	2	2	4	30.	4	9	13	0.4	1	11	12	75.	4	90	94	2.1
Pronouns	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	50	.....	4	4	1
Prepositions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Articles and Conjunctions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	58	22	80	96.3	659	904	1563	.....	65	59	124	69.7	492	966	1458	.....	98	61	159	43.1	1159	1771	2930	.....	122	104	226	48.6	1869	2528	4397	

	24 MONTH. Total. A. M.	P. M.	T.	In-crease Per Cent.	Parts of Speech Per Cent.	25 MONTH. Different. A. M.	P. M.	T.	Per Cent of Entire Vocab-ulary.	Parts of Speech Per Cent.	Total. A. M.	P. M.	T.	Parts of Speech Per Cent.	28 MONTH. Differ-ent.	In-crease Per Cent.	Total.	Total Per Cent.	31 MONTH. Differ-ent.	In-crease Per Cent.	Parts of Speech Per Cent.	Total	Total Per Cent
Nouns	89	89	178	48.2	60.	578	1246	1824	61.	113	81	194	44.2	48.8	878	1191	2069	48.4	279	42.8	3530	42.9	307	43.2	18.8	2168	24
Verbs	38	34	72	54.5	24.	230	393	623	21.	60	41	101	63.1	25.5	398	657	1055	24.4	141	59.	1978	24.	165	53.5	26.	2048	22.7
Adjectives	13	15	28	50.	9.	80	143	223	7.5	30	24	54	73.	13.6	153	186	339	7.9	78	62.	1060	12.9	79	50.6	12.5	1327	14.5
Adverbs	8	5	13	50.	4.4	60	129	189	6.4	18	5	23	74.2	5.8	291	334	625	14.6	31	.....	841	10.2	38	61.3	6.	1031	11.4
Interjections	9	2	11	55.	3.	34	43	77	2.6	4	10	14	51.5	3.5	10	47	57	1.	9	.....	38	.4	8	22.2	1.	198	2
Pronouns	2	1	3	75.	1.	7	15	22	.7	3	3	6	100.	1.5	48	72	120	3.8	12	85.7	690	8.4	15	88.2	2.	1761	20
Prepositions	1	1	2	25.	.....	.....	1	1	.....	1	3	4	80.	1.	3	7	10	.2	10	.....	87	1.	14	87.5	2.2	405	4.5
Articles and Conjunctions	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	100	.....	54	.....
Totals	149	147	296	48.3	.....	989	1970	2959	.....	229	167	396	53.4	.....	1781	2454	4275	.....	560	54.2	8214	.....	729	48.1	.....	8992	.....

The most surprising results in these tables is the large number of words used by the second and third children; being at two years respectively 729 and 741, and at two and a half years 1509 and 1432. The numbers at two years are thus about three-quarters as large again as the average of 419 for the first eight of the ten cases reported by Preyer.* This unusually large number we think is due chiefly to two causes. (1) The children in a family after the first child hear and learn many more words within a given period from their contact with an older child.† For our first child used only about 400 words, which is very near the above average from Preyer. In the second Wertheimer child reported by Preyer the increase was only from 435 to 489; and in the much younger comparison by Prof. Dewey his first child at nineteen was exceeded by the second child at eighteen months by 115 to 144‡ As against this explanation however is the record of the only other case of two or three children in one family, that of Dr. Holden, where the records decreased from 483 with the first child to 399 and 397 with the second and third children.§ But in all the other reported cases of single children it is probable that they were first children. For the enthusiasm for Child Study or Psychology usually breaks out with the advent of the wonderful first child, and vents itself as the novelty wears away and the heavier domestic cares with the second child dampen scientific ardor.

(2) But the increased record of words with the two younger children is also due, we think, to the greater experience and better method of making up the vocabularies. Especially is this advantage due to the added method of taking down the words for a complete day or several days as described above. For tho, on going thro the words recorded for the two younger children alone, to try to judge from a four years' memory what ones might have been used by the oldest child and missed in our daily notes on her, we could only make a possible dozen, yet the unreliability and illusions of memory have been forced upon us so often in our seven years of child observations that it seems quite probable that our recorded words of the first child are considerably below her real use.

*Preyer: Seele des Kindes. 4th Aufl. 1895. s. 378.

†This caution is referred to in a note by Prof. Dewey in his short article on "The Psychology of Infant Language," in the Psychological Review, Vol. 1, pp. 63-66.

‡Dewey: Ibid. p. 63.

§Holden: On the Vocabularies of Children Under Two Years of Age. Trans. Amer. Philological Assn. 1877. Vol. VIII, pp. 58-68. The third child only from Preyer, s. 374.

And with the much larger vocabularies of the younger children there would have been a proportionally larger loss in our record had we not taken their words for two or three days and so found many words we had missed.

These two causes then, which seem to account chiefly for the difference in the vocabularies of our two younger children as compared with the first child, seem to us to have operated still more in most of the other reported vocabularies of children and to account for the often amazingly small vocabularies given. Even more than in the first eight summaries reported by Preyer do these causes seem to have been present in the twelve summaries reported in Tracy: Psychology of Childhood, pp. 142-144. For the average of these twelve children from nineteen to thirty months old is only 257 words. Here then, as we have no information to the contrary, it is presumable that they were taken on the first or only child; and as no information is given as to the method of making up the vocabularies, it is scarcely probable that they were gained by our double method or even by the first part of our method in noting the acquirement of new words daily from the beginning of speech to two years or later. Therefore altho the vocabularies may be a fair enough proportion to be used, as Tracy does, for some law of initial sounds or even perhaps of the parts of speech, yet we cannot but think they give a gross underestimate of the size of the vocabulary of a two year old child.

Of course there is a wide extreme between the limits as to the use of words. Preyer's own boy used scarcely fifty at two years, while occasionally, as in one of our nephews, an otherwise normal child does not begin to talk till toward two and a half years; while an unusually talkative child, whose words I recorded during his second birthday, used over 800 different words on that one day. But we think our children are only average or perhaps slightly above the average in their use of language. And as our results are so much nearer those in Preyer we cannot think that the dozen children reported in Tracy were all so backward in their use of words, but that their words were by no means all recorded.

In the few published cases where the method of recording is given we think they too usually show incompleteness. In the case of Dr. Holden he reports merely that "only words are included which were actually used during the twenty-fourth

month of the child's life," (Holden: Ibid, p. 59), without describing how the words for this month were determined.* So not merely are the words not included which were used previous to this month and such as would still be usable in other seasons of the year, places, surroundings, with other persons, etc., but without following the children for several complete days, we do not think he could have gotten to within three-quarters of the real number used that month.

In another case it is reported that "of a working vocabulary at the close of the second year the child had in use 475 words.† But without some detail of the method and in connection with the many evidences of the unreliability and pedagogical pedantry of this monograph we cannot place much reliance on these figures.

As against the pretensions of this latter work it is gratifying to find the following simple and clear method used by Prof. Humphreys. "When the child was just two years old, aided by its mother I examined its words, one by one, in a dictionary, and marked such words as we were sure the child not only understood, but had spontaneously used, and still could use; whenever there was the slightest doubt, we drew the child into conversation with a view to eliciting the word in question, being careful not to let it hear the word from us; and if we failed to elicit the word at once, we rejected it. * * * The vocabulary, then, which I give is that of a little girl, and contains the words, whether correctly pronounced or not, which she had full command of when she was just two years old."‡

Tho this seems the best reported case so far and tho the total vocabulary of 1121 words is over twice as large as any hitherto reported and quite astonishing in its size, yet we cannot but believe again from our experience of the unreliability of memory that words were both used and rejected as not used, both with sufficient certainty of memory not to be subjected to the interrogation test. Whether these probable errors each way have increased or decreased the real vocabulary we cannot judge. The remarkably large number is not in itself against the trustworthiness of the record

*Dr. Holden has kindly explained by letter his method as follows: "I took down sentences for thirty days—all that I could—and I had two assistants in so doing. These were written in a book and then dissected and distributed. Every supposed new word was verified—often five or six times—during the month."

†Moore: The Mental Development of a Child. Monograph Supplement of the Psychological Review. No. 3. 1896. p. 130.

‡Humphreys, M. W.: A Contribution to Infantile Linguistic. Trans. of the Amer. Philological Assn. Vol. XI, 1880. pp. 5 and 6.

The dictionary method was used in the case of the son of President A. Salisbury of the State Normal School at Whitewater, Wis., when the child was 5½ years old, where the result gave a sum of 1528 words. And the child's mother had taken his words at 32 months by writing them out from memory one day and adding from day to day for about a month, resulting in a sum of 642 words. Both these estimates are undoubtedly to small.*

As more evidence for a larger vocabulary than is usually credited to a child we are fortunate to be able to give in Table III the vocabulary of Marion Martindell, of Milwaukee, which has just been completed.† Her mother, a former kindergartner, tried to put down the new words she heard each day; otherwise her own description of her method is as follows:

"A large part of her vocabulary was gained thro looking at pictures. She learned to recognize objects and their names from the pictures long before she saw many of the objects themselves. Up to one and a half years she lived in her picture books and then suddenly deserted them almost entirely and devoted herself to dolls and things in general. Her vocabulary as I have given it consists only of words used many times. Very many other words have been used once or twice, but apparently with no meaning, a mere imitation of sound. Such words I have entirely omitted. I think her just a good average (in her use of words) taking into consideration the time devoted to showing and telling her about pictures, which she so loved. No effort has ever been put forth to teach her anything. She has absorbed what she knows."

The MSS. of this vocabulary in chronological order was catalogued and indexed by us according to our method of classification, resulting in the Table III. The total vocabulary of 783 words is thus about forty more than our two younger children and Deville's child. It will be seen that the child began to talk unusually early and that it used an unusually large proportion of nouns and small proportion of verbs, 70.8% to 13%, (the adjectives and verbs are quite normal.)‡ But this is

*Salisbury: A child's vocabulary. Educational Review, 1894, Vol. 7, pages 289 and 290. Also thro the kindness of a letter of description.

†For the opportunity of using this valuable material we are under obligations to Mrs. C. S. Martindell, Milwaukee, and her sister, Mrs. A. W. Rankin, thro whom it first came to us.

‡In regard to this the mother writes: "I rather think I have overlooked the verbs and neglected to note them. It is a new work to me and I now realize that I have watched for the nouns in particular, possibly overlooking many verbs."

probably also accounted for by her learning so many words from picture-books, as described by her mother. And this fact made much difficulty and some doubt as to what of these picture-book and nursery-rhyme words were used by the child with real associations of meaning. Yet the vocabulary was evidently taken with great care and caution, and seems one of the most reliable yet made. But the most reliable record in Preyer's judgment and certainly so from our experience too, is that of the child of G. Deville, where the acquirement of words was kept by months from one to two years, during the last five months of which he began each month afresh by putting down all the different words it used that month and also a separate record of all the different words used on the first day of each of these months. It does not appear from his description that he took the entire talk of the child for these days, nor just how he got at the different words.*

The total vocabulary of 739 words at the end of two years, as that for each of the previous five months and the percentage of its vocabulary used on the first day of each of these months, are very near the figures of our two younger children. As then we have substantially followed Deville's method and our results so closely agree with his, and both our results together with Mrs. Martindell's, being about three-quarters larger than the first eight cases in Preyer and towards three times larger than the twelve cases recorded in Tracy,—for these reasons we still more believe that our figures are nearer complete and that most of the former records were greatly underestimated.

Words Used on One Day. This conclusion is very greatly strengthened when we come to study in detail our records of

*Preyer: Ibid. S. 379, 380.

Gabriel Deville: Notes sur le developpement du language. Revue de Linguistique, par de Rialle et Vinson. Paris: J. Maisonueuvre, 25 Quai Voltaire. (In last number of 1890, Vol. 23 and thro 4 numbers of 1891.)

"Pour les cinq mois qui ont suivi le 19e, il a été tenu note non plus seulement des mots nouveaux, mais de tous les mots entendus dans le cours de chaque mois. J'ai, au début de chacun de ces cinq mois, recommencé ce travail comme se la petite n'avait rien dit jusque-lá, n'inscrivant que les mots dont elle se servait d'elle-même en leur attribuant un sens précis. Quand, par example, elle répétait, même en le comprenant, un mot qui venait d'être prononcé, ce mot n'était pas inscrit, il ne l'était que lorsqu'elle l'employait spontanément à propos. En outre du releve'par mois, il a été fait pour le premier jour de chacun de ces mois le relevé du nombre et de la nature des mots entendus dans les conditions indiquees plus haut. Loin de chercher à allonger la liste des mots inscrits pendant ce premier jour, on a chaque fois évité avec soin de lui suggérer des sujets de conversation, d'atterer son attention sur des choses dont elle savait fort bien le nom, mais qu'elle ne songeait pas d'elle-même à nommer." (Tome 24, 1891, p. 34.)

the words used by a child during one whole day. In Table IV is given the tabulation of the words used by the second child, "2, boy", on the 350th day of his second year, and on the day he was two-and-a-half years old. We both were with him all day, taking turns as recorder with pad and pencil, the other one watching out to catch all he said and report it in case the recorder did not hear. This attention from us did not apparently disturb him, but he enjoyed our being with him thus all day. On the other hand it is doubtful whether our presence stimulated him to more talking than usual, and, tho it probably caused him to use some different words than usual, we tried to make it an average day in his life, playing with his building blocks and other plays indoors and outdoors. But he had no ride and was not away from the house,—both of which would have caused him to use some more different words. The "A. M." column gives the words used during the four and a quarter hours from waking at 7 to his nap at 11:15 A. M. The "P. M." columns thus give the words used during the other waking hours of the day from his waking from his nap at 1:30 to sleeping at about 8 P. M., making a total of 10¾ waking hours for the day. Thus on his day 350, year II, he used 243 different words during the morning period and 162 additional different ones in the afternoon period, making a total of 405 different words used during the day. It will be seen in the percentage columns that he used proportionately more verbs and adjectives in the A. M., and this was balanced by more nouns in the P. M. But of the total words said he used over one-third more in the P. M., thus using in his whole day's talk a total of 5,194 words.

Up to that day he had used 635 different words, and calling this his entire vocabulary on that day he had used 64% of his entire vocabulary with his single day's use of 405 words. This, however, is not deducting some 35 words which he seemed according to our memory to have used that day for the first time, but owing to these illusions of memory and the great improbability of his using so many new words in one day, we could not attempt to make any correction for this.

On the 182nd day of his third year he had no nap, but the continuous 11½ waking hours from 8:00 A. M., were divided off into three periods of 4½, 4, and 3 hours respectively. Here it is interesting to find how large a percentage—nearly 64%—the 479 different words used during the first period of 4½

hours of the day are of all the 751 words used this day. Tho of course the different words decrease during the 2nd and 3rd periods of the day, the total words keep about proportionate to the length of the periods. The total number of 9,290 for the entire day's talk is astonishing in the energy of the child represented therein.

In Table V are given the words used by 3, girl, during the beginnings of months 20-25, 28 and 31. The first six days were divided into A. M. and P. M. parts by her nap. These parts of these days were in about the proportion of 1 to 2.*

It will be seen that in month 20 she used nearly all the words of her small vocabulary to that date, viz., 96%. But by month 21 her proportion dropped to 60%, and from thence varied irregularly between 43% and 54%. Thus our tables do not show the regular decreasing proportion of words used to the whole vocabulary, which Preyer found in Deville's data, tho his average of around 50% is confirmed by our material. The proportion of nouns used to the entire vocabulary was lower and also not so constant as Preyer likewise found, for while his varied from only 60 to 66%, ours varied from slightly less than 50% to 62%. (Preyer: Ibid. s. 380, 379). The proportion of the other parts of speech did not keep at all so constant as one might a priori expect.

In comparison with 2, B. it is seen that she used less words, both different and total, than on his corresponding days. This comparison at least is thus contrary to the supposed rule that girls talk more than boys. But the number of different words is almost the same as those used by Deville's daughter, being for the same days as our 3, G. respectively 95 and 80, 133 and 159, 170 and 159, 212 and 226, 255 and 296.

Tho there is a progressive increase each month in the different words used there is, strangely enough, not a monthly increase in the total words of the day's talk; those on months 22 and 24 being almost equal, while those on month 23, amounting to 4,397, were more than in month 25.

To test our judgment of our children's being only about the average in their use of words, we took the opportunity of following a reputedly talkative child, Carl Andrist (whose father was Instructor in French in the University of Minnesota, and whose mother had been a Kindergartner), during his

*The exact divisions of the eight days were as follows: For mo. 20, 4:10 and 7:20; mo. 21, 3:30 and 6:45; mo. 22, 3:40 and 8:10; mo. 23, 4:15 and 8; mo. 24, 4:25 and 7:30(?); mo. 25, 4:30 and 7:30.

second birthday. One of us (H. G.) got acquainted with him some weeks beforehand so that a strange presence with the child all day would not disturb his usual routine of life. The child's reputation was most astonishingly sustained by his using 805 different words and 10,507 words altogether as shown in Table VI.*

TABLE VI.

WORDS USED BY CARL ANDRIST ON HIS SECOND BIRTHDAY.

	Different	%	Total	%
Nouns	402	50.	3106	29.5
Verbs	206	25.5	2871	27.3
Adjectives	64	7.9	594	5.2
Adverbs	48	5.9	1101	10.4
Interjections	21	2.6	95	0.9
Pronouns	45	5.5	1806	17.
Prepositions	15	1.8	699	6.6
Arts. & Conjcns	4	0.5	236	2.2
	805		10507	

Allowing little Carl the high percentage of having used 65% of his total vocabulary on this one day the above trial would give him a probable vocabulary of about 1,400 words, which would be some 275 more than Prof. Humphreys' largest vocabulary at two years yet reported. And thus he used about as many words at two years as our two younger children did at two and a half.

One of the results of these figures on children's use of language is to make one question very decidedly the philological legend that a working man uses only about 500 or even 300 words and that an educated man uses only from 3,000 to 4,000.†

*The compilation of these results was made by Mr. A. H. Dunlap of my Seminar in Child Psychology.

†See, e. g., Max Muller: Science of Language. First Series. 1870. "Now we are told on good authority, by a country clergyman, that some of the laborers in this parish had not 300 words in their vocabulary," (p. 266) referring to A. D'Orsey. The Study of the English Language, p. 15, which work we are not able to find. "A well-educated person in England, who had been at a public school and at the University, who reads his Bible, his Shakespeare, the Times, and all the books in Mudie's Library seldom uses more than about 3,000 or 4,000 words in actual conversation." pp. 266 and 267. Cf. also G. P. Marsh: Lectures on the English Language: First Series. 4th Ed., 1874. "Ordinary persons of fair intelligence use not above 3,000 or 4,000." (pp. 182 and 270). And, legend-like, the marvel increases with age, as in Wendell: English Composition, 1897, where we are told that "for everyday purposes a thousand or so prove amply sufficient." (p. 67). Even in the justly celebrated address by Horatio Hale on "The Origin of Languages, and the Antiquity of Speaking Man," one finds the following startling inference based on such a bare conjecture. "As we know, however, on excellent authority, that the conversation of English laborers has been found to be carried on with no more than a hundred words, we may believe that the talk of the children might be fluent enough with a much more limited vocabulary. 'I once listened,' writes Archdeacon Farrar, in his work on 'Language and Languages, 'for a long time together to the conversation of three peasants who were gathering apples among the boughs of an orchard, and, as far as I could conjecture, the whole number of words they used did not exceed a hundred; the same word was made to serve a variety of purposes.'" Proceedings Amer. Assn. Adv. Science. Vol. 35, 1886, p. 290. cf. Farrar, Chapters on Language, 1865, p. 59, where he also quotes D'Orsey, whose statement he says his experience confirms.

Has anyone ever really counted or reliably estimated the words of a working man? And if so, what method has been used? For when from the above tables we find that a two-year-old child has a vocabulary of some 700 words and some 1400 at two-and-a-half years, and that it uses half of these vocabularies on an ordinary day, it is quite incredible, without some scientific evidence, that any normal adult uses only some 500 words. For though of course a working man would not keep up the stream of talk of a child during one day, yet with his vastly wider environment of merely his eating, drinking, sleeping, tools, barn, and labor, it is most probable that his vocabulary has been vastly underguessed. And for the educated person, instead of the paltry 1000 to 4000, it is far more probable that Dr. Holden's estimate of some 25000 is much nearer the truth.* By counting the words we used in two separated tenths of Webster's Dictionary we made a rough estimate that our untechnical vocabulary is between 30 and 35 thousand words, thus agreeing closely with Dr. Holden's estimate for himself.

Another result from the tables is the great energy and activity shown by the child in its use of words. One comparative measure of this has been pointed out by Tracy in the child's use of a much larger proportion of verbs than the adult. (Ibid. pp. 146-148). Our Tables I and II add more evidence to this about 20% proportion of verbs in the child's vocabulary. But another index of activity is furnished by the proportion of verbs and adverbs in the total talk of the child for the day. In Table IV it will be seen that of his different words 2, B. used on his 350, II, day 24% of verbs and 7% of adverbs, while in his total words for the day his verbs amounted to 20% and his adverbs to 15%. Likewise for his 182, III, day his different verbs and adverbs were 25% and 5.5%, while his total were 23.6% and 14%. With 3, G. in Table V are found her different verbs and adverbs used on the first days of months 24, 25, and 31. These are respectively 24, 26 and 25.5%, and 4.4,

Prof. Salisbury's article, "A Child's Vocabulary," in the Educational Review, Vol. 7, pp. 289 and 290, begins with the following quotation from Laurie's Lectures on Language and Linguistic Method, p. 23: "In the child up to the eighth year the range of language is very small; he probably confines himself to not more than 150 words," and in a private letter added, "My authority was a statement in a philological article by Max Muller that I read long ago in the Edinburg Review."

In his valuable notes "An Infant's Progress in Language," in Mind, Vol. 3, 1878, pp. 393-401, F. Pollock adds to his not having time to take down all his child's new words from the 18th month,—"I also doubt if anything would have been gained by it."

*Holden: Ibid. pp. 58 and 59. By an approximate method (not described) he found his own vocabulary to amount to 33456 words. On the basis of this and similar results by two of his colleagues he concludes "that 25000 words and over is by no means an unusual vocabulary for persons of average intelligence and education."

6, and 5.8%; while the proportion of total verbs and adverbs are respectively 21, 24.4, 22.7%, and 6.4, 14.6, and 11.4%. It is remarkable that on the last day her words were taken (mo. 31) she used nearly as many verbs as nouns (2048 to 2168). It will be seen that with the anomalous exceptions of the first days of mos. 21 and 22 the percentage of total verbs used on these eight days ranged from 20 to 24%. The exceptions of these two days with their only 11% of verbs intensify our already arising doubts as to how far the activity of the child can really be inferred from the verbs and adverbs alone. For in these months the child was only talking single words and no sentences, so that here especially many nouns were ejaculated with desire and motion for things. Thus it seems as if the sensori- and ideo-motor tendencies of the child were stronger and less differentiated than in the adult.

In the case of Carl A. in Table VI not merely did his total adverbs make a larger proportion than the different adverbs, but also, as had not occurred in our children, the total verbs made a higher proportion than the different verbs, being 27.3% to 25.5%. This total percent of verbs at 27.3 is the largest proportion of verbs in our tables, and is again only 2% behind the totals of his nouns.

The total words used during a day is 8992, 9290, and 10507, giving us a new measure of the energy in a child. Would that it could be measured or tested more exactly!

In the number of repetitions of a single word one gets a measure too of the energy used, as on finding that 2, B. used his own name "Sammy" 1057 times on one day (as subject, object, and possessive, in place of the personal pronouns), while 3, G. used her favorite "little" 660 times, "that" 609 times, and the aggressive ego words "I" "me" and "my," 970 times.

These comparative frequences in the total words used are an interesting index of the interests of the child as well as of its energy. The following list are those used most often on their two and a half year days.

2, B.	3, G.	2, B.	3, G.	2, B.	3, G.	3, G. Cont'd
Sammy, 1057.	85	need.	193	some, 134.	86	what, 95
Papa, 350.	34	see, 128.	167	no, 292.	166	where 91
Mama, 193.	72	going, 124.	86	yes, 104	130	why, 62
Dick, 148.		don't, 123.		now, 151.		please, 157
Hilde, 62.		go, 97.	53	there, 134.	52	I, 487
boy, 45.		get, 88.	55	down, 105.		me, 81
bed, 42.		put, 86.	148	here, 100.		my, 403
house, 41.		will, 79.		that, 226.	609	
water, 34.	49	did, 66.		this, 116.		
Sammy's.	31	was, 61.		in, 145.	110	
baby.	183	have, 56.	193	to, 147.		
doll.	84	take, 55.	97	little.	660	
pillow.	67	can't,	122	not	91	
pillow case.	17	can	35			
		want, 204.	61			

Such a list shows the child's interests centered egotistically, and naturally too, around his primitive struggle for existence. The aggressive want, need, go, get, put, will, have, and take; the offensive don't and can't; "the everlasting no" always taking precedence of the submissive yes; the demonstrating that, this, there, here, in, and to—all show the natural pleasure-pain life in its immediate expression in ceaseless activity and its conflict with the old-time environment of fate. But yet the cohesive society instincts are evidenced by the use of his parents' and sisters' names or baby and doll even more than of the other objects of play or novelty, and by the sympathy and approbation shown especially in his large use of see and some, (as in "see S. do this" and "P. have some.")

But turning from this tabular evidence of the great role for language and education which activity plays with the child, one gets a vivid and fascinating picture of this activity in reading through the full record of a child's talk for a day. Even before words were put together into sentences and while they were still all single ejaculations with their puzzling mixture of grammatical meaning the following activity was shown at the beginning of 3, G's. first day of the 20th month:

"Bottle-bottle-bottle. Baby-baby-baby. Book. Lamb-lamb. Book. Toad-lamb. Want-want. Bottle. Cow. Dog. Pat. Lamb-lamb. Papa. Dick-Dick-Dick. Lamb-lamb. Bow-wow, bow-wow. Little-little (boy). Lamb (twelve times). Bow-wow. Dick-Dick. Write. Boy-boy-boy. Dick. Baby-baby-baby-baby. Doll. Eye-eye. Want-want. Warm (seven times). Bow-wow. Doll-doll. Poor. Lamb-lamb-lamb. Dick-Dick. Lamb-lamb. Dick-Dick. Lamb-lamb. Eye-eye. Write-write-write. Pat-pat-pat-pat. Water-water. Pillow-

pillow. There-there-there-there-there. Little (toes five times.) Pin (nine times) There. Wash (twelve times). Baby-baby. Hand-hand-hand. Bye-bye baby (singing). Pull-pull. Away (nine times). Wash-wash. Away-away (cried hard at not being allowed to wash herself)."

Compare this with the greater activity and the far greater definiteness of her words eleven months later when she was two and a half years old. In her first play for the day with her doll, about three quarters of an hour after waking and before breakfast, 3, G. kept up the following stream: "My little baby, my little baby. Momsie, Momsie, jiggle my little baby, jiggle my little baby. Please put that little pillow in, put that little pillow in—little pillow in. I did put. Just little tiny bit, little tiny bit,—little, little, little. Going take nightgown off. Safety pin, safety pin. Put that on bed. Going put that on, going put little pillow way. Please help me put my little baby's sleeves in. I call that my little baby. Why I—I—I? Try pin. Can't pin. Why write that way? Don't want my pillow,—want that pillow,—want—. Where that little baby sleep on my pillow? (Repeated). Why do just like that way? That bed spread lie on. (repeated). Little baby,—cover legs. (Sings): Sweet little baby,—Oh little baby, Oh little baby, Oh little baby, Oh little baby. Put that,—that bed-spread little baby lie on,—have bed-spread. Go right off. I going put my hands on that. Try make that stick together,—stick together; try make that stick together,—go together all nice. My little baby can't lie. What? what? I used my—away back on Mamma's bed. Can't tell Hilsie that. My baby got two little shoes, two little stockings on. (Repeated). Can't take off. My poor little baby got go bed, got stay in bed. Got little neck, little neck, cunning little neck,—little neck. Please unpin that safety pin, Momsie. My little baby not very well,—have stay in bed. No, my little baby's nightgown,—that Grandma made (latter four times)—other Mamma made me,—that Emma made me, that Emma made me. That Mamma crochet, Mamma crochet other one—other one. Hasie have that one (repeated twice) that one. My little baby have sleep on,—where my little pillow? Got little chin. Why do that way? Got no nightgown. Play with little safety pin." (She then changed off to another doll).

Of course the above was interrupted by some talk from other members of the family, but we tried to leave the child to

its own activity and spontaneous talk as much as possible. The following extract shows some of the different interests and activities due to sex. Right after his dinner at noon, 2, B. began thus: "Papa come upstairs and build with Sammy. Fix Sammy big fid(dle). S. will fix big one. S. want only—S. want Mamma, one lady and one man. Oh Anna, S. see Bannie (made-up word). No, no, S. going to build little house for children. No wood—build with stone ones. No, S. want these. Put those in closet. S. want new (blocks). P. get some. Little P. get little S. Want some. No, S. will let S. S. going make pretty nice fairy house. This going be little door down here, so can't get out. This tiny one can't get out,—get out and get in. And that down there,—that there down beside and that, that side-arch. S. going to build nice, fairy house. Mamma, when P. was little, P. did hump, hump. (laughing). Yes, S. thought he was Bannie, Bannie. (Pause, playing with stone blocks alone). S. has to finish with these blocks. S. need old block—S. need old block. No, no, no, that little boy, little boy. He going to go thro here. That S. mat. This does take all block. There P. big fid.S. don't see P. big fid. S. have to play, have to play. S. have to put P. big fid,—P. Fiedelbogen. Yes. What this? S. want,—Hilde, H., H., (the four months sister getting into his things). This little boy S. will give H. S. want that whip. S. going to get green Decke. Don't put Dick baby on (repeated). Little boy,—No, no,—S. want that little boy. H. did take little boy. Isn't something to eat, H. No, no, but S. want, H., H., H., want. Take H. H. don't want. This for H. S. can suck. Oh, there baby,—isn't down on floor. Take H., take H. Don't take,—here boy, here boy. Oh, some (nonsense syllables). Yes. Mamma now S. Oh, here was hat. S. found hat,—S. found boy hat. Shan't we, P.? No, S. won't come up till P. come up. S. got block lean over. P. now come up. M. don't get on S. block. S. got blocks lean over. P. build with S. P. build fountain-house. S. have to build P. long one, P. Now P. build with S. P., now S. P. know those go down there,—belong. Now S. will put arch up there. P. build with those. Put other arch up there. P. build with S. Now take this block and build down there,—now put across there. H.,—why, why, H.! Take that H. P. now take this. P. now,—Oh, build P. No, no, no, that arch down here. No, no,—Oh, S. will give H. rubber doll. There H. Now P. sit down,—H. got rubber doll."

It is astonishing how this activity keeps up to the end of the day and the child struggles against fatigue and sleepiness. After having looked at his Brownie book in bed awhile he was laid down by his mother to be sung to sleep as usual and the gas was turned down. Whereat he said: "S. can't see—S. can't see. P. now give S. some more paper to write on, two more and that will be all. Sammylein, Hildelein, Mammalein, Dicklein, and that will be all. S. can't see. (Repeated five times, and seven Nos.) Yes, S. want drink. Now, P. drink some,—now S. want 'nother drink. Now don't write M. S. isn't getting tired. This Water Baby. Why? Go way up to that corner. S. don't want to. S. isn't sleepy. S. got jelly glass at S. house. M. don't turn down gas, don't, don't, don't. Where P. go? No, no. (Finally weakening he says) S. want go S. bed. S. want green Decke. S. want S. pictures. M. sing some Schub(ert). Was this right way? No, this was wrong way. M., this right way? (adjusting his beloved green Decke), this right,—yes. M., S. want those two pieces paper,—give S. some paper. S. have to roll up. M. cover S. Where P.? Where P.? M. where P.? M. sing loud. M. lie down on P. bed," when the Männlein suddenly fell off to sleep.

Another feature in which the vocabularies surprised us was in the number of words which were not used in common by the three children or even by any two of them. For we had supposed a priori that children in the same family, in the same house and rooms, with the same habits of living, almost the same toys and books, with the same and an unusually narrow circle of acquaintances outside of this house,—that growing up under almost identical influences, they would use about the same words. And it was only on getting the three vocabularies side by side in the above form that we were confronted by the astonishing diversity of the words used by the different children in the same environment. A count of the words used by all three in common, by each pair of children in common, and by each child exclusively gives the following Table VII.

TABLE VII. Community of the vocabularies used to 2 1-2 years by

	All 3 in common		3 G. & 2 B.		3 G. & 1 G.		2 B. & 1 G.		3 G. alone		2 B. alone		1 G. alone		Total dif. wds. used by 3 children & per cent
	Per cent		Per cent		Per cent		Per cent		Per cent		Per cent		Per cent		
Nouns,	268	20.2	170	12.8	40	3	46	3.4	416	31.3	303	22.8	83	6.2	1326 61.1
Verbs,	113	28.3	96	24.1	12	3	9	2.2	84	21-1	70	17.5	14	3.5	398 18.3
Adjectives,	64	28.5	33	14.7	11	4.9	16	7.1	46	20.5	40	17.8	14	6.2	224 10.3
Adverbs,	19	19.1	24	24.2	3	3	5	5	16	16.1	29	29.2	3	3	99 4.5
Pronouns,	8	22.8	7	20	1	2.8	5	14.2	1	2.8	10	28.5	3	8.5	35 1.6
Prepositions,	9	36.	5	20			1	4	1	4	9	36			25 1.1
Interjections,	5	9.8	9	19.6			2	3.9	22	43.1	12	23.5	1	1.9	51 2.3
Conjunctions	3	25.					1	8.3			7	58.3	1	8.3	12 .6
Totals,	489	22.5	344	15.9	67	2.1	85	3.9	586	27	480	22.1	119	5.5	2170

Thus out of the 2170 different words used between all three up to two and a half years of age, they only used less than a quarter of these in common (489); while 2, B. used 480 and 3, G. used 586 words exclusively, i. e., not used by either of the other children. The two younger used about 16% in common, and the fact that each of these used so few in common with the oldest child is probably due to our vocabulary of her being so comparatively and unfairly small. That the diversity between 3, G. and 2, B. is not necessarily due to the difference of sex is shown by a comparison with the two girls of Dr. Holden,

whom he also expressly records as being as nearly as possible exposed to similar surroundings, where we found by making up Table VIII that they used 40% in common. This is only slightly more,—on the basis of vocabularies only about half the size of ours,—than the 38½% used in common by our

TABLE VIII.

Summary of the Community of the Vocabularies used by the Two Older Children of Dr. E. S. Holden.

	Both in common	Per cent	Older alone	Per cent	Younger alone	Per cent	Total different words used between both
Nouns,	160	43.3	133	36	76	20	369
Verbs,	58	35.5	60	36.8	45	27.6	163
Adjectives,	20	39.2	14	27.4	17	33.3	51
Adverbs,	8	21.6	21	56	8	21.6	37
Others,	15	41	13	36	8	22	36
Total,	261	40	241	36.8	154	23.3	656

younger boy and girl. It is seen that 1, G. had more in common with 2, B. than with 3, G., tho this may be due to their order and nearness of age. Later on the sex would of course make a considerable difference in the vocabularies, but up to two or two and a half years it does not seem to differentiate the vocabularies, tho then it makes a sex difference in the total words used in the whole day's talk. While the individual exclusive use of 36.8% by Dr. H.'s older girl is very high, that of 28.3% by his younger lies between the exclusive 27% and 22% of our 3, G. and 2, B. The percentages of the parts of speech show that while the larger proportion of these exclusive words were due to different nouns used, as in the case of our children, yet they were not so preponderatingly there as we supposed they would be, but were distributed thro all the parts of speech and often with unusual personal differences, as the percentages of interjections with 3, G. and of adverbs, prepositions and conjunctions with 2, B. and Dr. H.'s oldest child. These large individual differences as to the stock of words which children in the same environment use, show again the wide actual limits and possibilities of a child's vocabulary. For the great mass of these words are the common ones of life about us.

To find an explanation for these differences one is inclined in a rough way to ascribe them to the varying individualities of the children. But tho it happens that our children are each quite individual and different from the others, yet we cannot see in their exclusive vocabularies any correlation to their special characteristics. Some are, after all, seen to be due to changes in the environment of persons, toys, books, or place, as, e. g., many words used by 3, G. in months 21-24 relative to water, boats, and country life, when living three months at a summer lake cottage where 2, B. had lived much less and 1, M. not at all at their corresponding ages. Some were gained by the younger or youngest and used within the two or two and a half year limit from the older child, who used them after that limit. But by far the greater part appear to be due to such inexplicable variations of interests in the children as to be popularly ascribed to chance. However, where chance stands for ignorance it will finally give way to some causal explanation, and in this case we think these variations of interest can be reduced one further causal step by the laws of pleasure-pain determining these individual interests.

Much help, however, can be gotten for this problem by the larger question to which we are finally lead, viz., what is the reason why a child gets a certain vocabulary and in a given order? One explanation offered is an extension of the law of the ease of utterance from explaining the progressive sounds used by the child for words to explaining the words themselves which the child tries or means to use.*

But tho the stock in common is on the whole the easiest and the individual variations are toward the hardest, yet the short words with the easier initial or imitative sounds seem to be used because of their necessity or interest to the child's life, as, e. g., the early words baby, cow, papa, mama, book, horse, dog, bottle, water, doll, pin, mittens, burn, see, take, want, eat, wash, pretty, hot, dirty, warm, broken, clean, sticky, another, there, off, away, quickly, good-bye, hurrah, peek-a-boo, etc., etc. The

*See Schultze: Die Sprache des Kindes (1880), s. 27, for the use of this principle in the sounds used by the child for words. But Holden had already applied this principle to the words themselves which the child successively used and thus made up his vocabulary. "I am inclined to take it as a result of my inquiry that the ease of pronunciation, far more than the complexity of the idea, determines the adoption of the word." (Ibid. p. 60). But of this principle Humphreys said: "Although it had some influence before the child was one year old, when she was two it had ceased to have any effect whatever. She had, by that time, adopted certain substitutes for letters which she could not pronounce, and words containing those letters she employed as freely as if the substitutes had been the correct sounds." (Ibid. p. 7). For Preyer's arguments against the principle in both its applications to the sounds and to the real words see his pp. 367, 373, and 374.

growth of language in the race has brought about the fact that the words most necessary to the child's life are the shorter and easier sounds. Thus the child uses them first because of their interest thro their serviceableness and not because of their ease. So glancing down the chronological columns of the vocabularies one can see how the compound words came into use later on, along with the finer specialization, as shown also in the short words of the more exact adverbs, prepositions, conjunctions, etc.

Thus, too, many quite as easy words come to be used much later when they become useful or interesting, as mat, muff, people, joke, note, lace, veil, care, screw, bone, gas, glue, guess, give, fill, feed, tell, buy, shine, scrub, sure, like, and soft. And, again, the long and hard words are used at any time when needed by the child's interests by using the nearest imitative sound the child can make to some identifying syllable or by some dissimilar and original sound. Thus they associated some sound which served as a word for nigger-book, handkerchief, petticoat, toboggan, umbrella, Brille, hammock, Brightwood, University, perfumery, Bauchknopf, apple-sauce, rocking-chair, dein ist mein Herz, chimney-sweep, Pantoffeln, peppermint-candy, wastepaper basket, Miss Haversham, David Copperfield, Thomas Orchestra, Beethoven, Brahms, buttonhole scissors, magnifying glass, Kohlpechrabenschwarzermohr, (in which 2, B. only left out the two syllables en and er) telephone, vaccinate, be reposed, collapse, headerei (to be carried on one's shoulders, originated themselves from washerei) kitzeln, remember, disturb, comfortable, precious, old-fashioned, day after tomorrow, guten Morgen, guten Abend, auf Wiederschen.*

We believe then that the acquisition of words by a child is mainly, if not wholly, accounted for by the psychological laws of pleasure-pain, viz., (1) the biological law that whatever is favorable or more immediately beneficial to our organism is pleasurable and the harmful is painful; (2) between these extreme limits things are further differentiated as pleasurable or painful by being associated with things already differentiated by the biological law, and so this principle of association comes indirectly under (1); (3) by the habit or custom principle whereby we come to have pleasure in anything long-contin-

*Each of these three points are seen also in the chronological vocabulary of Mrs. Martindell's child, the only other chronological list which we have found.

ued which is indifferent to the welfare of our organism or not so immediately harmful as to kill us in the process of adaptation.

Thus under the first principle of advantage would be the word baby or name for itself, the early papa, mama, nurse, older brothers and sisters, and others attentive to its wants; its food words of milk, water, drink, eat, suck, choke, mouth, taste, blow; the words of protection and care as bed, pillow, Decke, stockings, wash, hurt, prick, burn, bump, sore, sick, tired; the words expressive of desire and activity in want, need, go, come, pound, take, walk, stand, see, bite, cut, open, own, afraid, away, down, no, there, up, here, now, quick, lost. Also under this principle would come a large mass of words relating to things about the child which are pleasurable thro their novelty, unless they are so strange as to be fearful. We have many notes of the often uncertain limits between the novel and the fearful; and, indeed, in one way it seems as if the child's world was divided into these two catagories by this instinctive pleasure in moderate novelty and pain in the fear of too great novelty. As far as it is for the advantage of the child to have this pleasure in novelty as a stimulus to gaining a knowledge of the world about and this fear of the too-strange as a protection to its safety,—thus this class of words would come under this first biological principle. But as to the objects to which these feelings are attached, this novelty-fear class would largely come under the third principle of habit or custom.

Under the second principle of association would thus be things connected with its food as bottle, spoon; with its care as brush, garter-straps, sleeve, button, door, blind, Bullen's store; with its parents or caretakers as Brille, University, gingham, hugerei, sticky, greasy; and in the beginnings of its aesthetic life in blue, Rheingold, Schubert, "Blondes Köpfchen," Beethoven, Brahms, Goethe-book, David Copperfield.

Under the third principle of habit or custom would be such things in the novelty class, as suggested above, as dog, kitty, duck, Papagei, telephone, center-board, Paulinchen; such things as lawn, lace, tooth-powder, cupola, newel-post, whiskey; such interjections as good-bye, hurrah, please, mercy sakes. One of the best examples of this class are the special kinds of foods. For beyond the instinctive four tastes the smell elements, which form such an overwhelming part of

the flavors in our foods, are a mere matter of habit. Thus a child accustomed to one kind of breakfast-food, toast, meat, or milk, objects vigorously to taking any other that smells or looks different; but, having gotten accustomed to the new kind, it objects as strongly to eating the old kind.

It will be seen that in general the earlier words and those used in common by the three children come more under the first principle of advantage, while the later words and those in which the children differ from each other come more under the other principles of association and of habit. Also the more necessary words are those acquired at nearer the same corresponding age, as shown by the nearness of the numbers for the three children in the left-hand column; while those due to the association or habit principles show more individual times of acquirement. But a more detailed study of the vocabularies in relation to pleasure-pain is reserved for a future number of studies on that subject.

Words then are simply the tools whereby the child gets more pleasure and avoids more pains. And the number of these words is normally only limited by the pleasure-pains which are of sufficient intensity to make the motor connections for speaking the words. We have many observations how this association of the sound with the thing was made without any apparent attention to the sound; so that when the child's pleasure-pain interest in the thing was enough for it to want to use the word, out it popped without any previous trial or practice. If the child merely lives in an environment where the words are heard or, later on, seen in books, the words get themselves ready for use when needed. How opposite is this natural, easy, and largely subconscious process of getting all the words needed to express the child's feelings and ideas from the artificial, pedagogical and rhetorical practice of laboriously getting up an advance stock of mere imitative verbal sounds before one has any feelings or ideas to express!

SUMMARY.

1. By a comparison of the methods and results in taking the vocabularies of our three children with others it appears that most of the published summaries have been greatly underestimated.

2. Owing to the weakness and illusions of memory the most trustworthy method to take a child's vocabulary is to

record the new words as heard each day and then periodically to take a whole day's talk to check off with the chronological list.

3. The vocabulary of an average two-year-old child thus appears to be about 700 words; and in the next six months it doubles to about 1400 at two and a half years.

4. A child uses from 50% to 65% of its entire vocabulary on any one day.

5. A child's vocabulary being so far larger than the popular guess or attempted estimate,—this makes one decidedly doubt the ridiculously small guesses of the philologists as to the vocabulary of adults.

6. The total talk of a child for a day—from 5000 to 10000 words—the number of repetitions of its most-used words, or even a verbatim report of its talk for a half-hour, shows its immense activity and its real education thro this activity.

7. Children in the same family and environment show surprising individual differences in the vocabularies used; two such children having less than half their vocabularies in common and over a quarter of them exclusively.

8. The words making up a vocabulary, the order of its acquisition, and its community or diversity with other children's, seem chiefly accounted for by the pleasure-pain element attached to the hearing knowledge of the word. So that, if there is sufficient interest in anything to use its word which has been heard, the motor connections having been subconsciously made, some sound is used for the word without practice.

TASTE AND SMELL IN ARTICLES OF DIET.

By Roy W. Tallman, with Postscript by H. Gale.

Tho Physiological Psychology is related particularly to the phenomena concerning the special senses yet but little attention has been paid to one of the most interesting of these phenomena, namely, the close relation existing between the perceptions of taste and smell. If the sense of smell is cut off by closing the nostrils the range of one's apparent taste is restricted to a degree that is astonishing.

This fact has been occasionally alluded to and commented on by writers, but no definite attempt, that is known to the writer, has ever been made to investigate this very interesting field.*

Object of Experiments. Before we can begin to discuss the sense of taste we must first of all differentiate that sense from the train of sensations which accompany it. What part of that complex of sensations which result from placing a piece of broiled beef-steak in the mouth and masticating it and which we commonly designate as taste is due to taste, used in its pre-

*Mr. Tallman's article was completed in the spring of 1898. Since then has appeared the very important article by Prof. G. T. W. Patrick, "On the Analysis of the Perceptions of Taste," in his Studies in Psychology, pp. 85–127, which is a Bulletin of the University of Iowa, New Series, Vol. I, No. 5. This is by far the most valuable contribution in English to the whole subject of taste. The larger importance which Mr. Tallman attaches to smell in our supposed taste and the greater ignorance of our observers when smell was excluded is probably due to the fact that our results were gathered from fewer trials with each observer, tho with many more observers, than Prof. Patrick's results. From my own considerable apprenticeship to Dr. Kiesow in Leipzig and my experience in these experiments I well realize too the great individual differences due to the real complexity in this apparently simple sense.—H. G.

Some incidental references were made to this subject in the following articles:

"Delicacy of Sense of Taste," by E. H. S. Bailey and E. G. Nichols, in *Nature*, Vol. XXXVII, p. 557.

"Food and Feeding," in the *Cornhill Magazine*, Vol. I, p. 617.

"Sensation of Taste," a review of "Contributions to the Sense of Taste" by Friedrich Kiesow, written by the author of the work in the *Psychological Review*, Vol. II, p. 89.

The original studies by Dr. F. Kiesow are as follows: Beitræge zur physiologischen Psychologie des Geschmacksseinns. Wundt's Phil. Studien, Bd. X. s. 329-368, 523-561; Bd. XII. 255-278, 464-473. Zur Psychophysiologie der Mundhœhle; Ibid. Bd. XIV, s. 567-588. Schmeckversuche an einzelnen Papillen; Ibid. s. 591-615; Kiesow und Hoeber: Ueber den Geschmack von Salzen und Saugen. Zeitschrift fur physikalische Chernie, Bd. XXVII, s. 601-616.

Prof. H. Newell Martin in his "Human Body," advanced course, p. 572, briefer course, p. 334, has the following, which we quote in full:

"Many so-called tastes (flavors) are really smells; odoriferous particles of substances which are being eaten reach the olfactory region through the posterior nares and arouse smell sensations which, since they accompany the presence of objects in the mouth, we take for tastes. Such is the case, e. g., with most spices; when the nasal chambers are blocked or inflamed by a cold in the head, or closed by compressing the nose, the so-called taste of spices is not perceived when they are eaten; all that is felt when cinnamon, e. g., is chewed under such circumstances is a certain pungency due to its stimulation of nerves of common sensation in the tongue."

cise and proper sense? What part is due to smell, arising from the contact of the aroma of the broiled beef-steak with the olfactory nerves? What part is due to the touch? The tongue, especially the tip of the tongue, is most supplied with nerves of touch as well as nerves of taste.*

What part is due to suggestion or associated ideas, which play a greater part in our perceptions of what we eat than we think? An attempt has been made in this article to answer some of these questions by differentiating the components of apparent taste or flavor.†

The conclusions that are drawn are the results of many experiments by students in Mr. Gale's Junior and Senior year Psychology classes of the University of Minnesota. The experiments, which were performed by students during the years of 1894-1898, have been carefully collated and, in cases of differing results, verified by the author.§

Tho the primary object of the experiments was to ascertain the components of apparent taste, yet incidentally other matters forced themselves into notice, as will be brought out in the description of the experiments.

E. W. Scripture in his "Thinking, Feeling, Doing," 1895, has the following interesting page: "When the sense of smell is entirely lost the ordinary flavoring syrups, such as vanilla, currant, orange, strawberry, and raspberry, give merely a sweetish taste with no distinction among them. Lemon syrup tastes sweet and sour. Candies flavored in this way taste alike. Mustard and pepper produce sharp sensations on the tongue; there is no difference between them except that pepper is sharp; neither produces a real taste. Tea does not differ from water or coffee, Rhine wine from diluted vinegar. Ginger and cloves are alike. Powdered cinnamon, when placed on the tongue of a person whose eyes are closed and whose nose is held between the fingers, is considered to be like meal.

Wines owe their bouquet entirely to smell. The most exquisite Schloss Johannisberger does not differ from diluted vinegar as far as taste goes. The wines of Eastern Prussia are reputed to be at present good for nothing but to make vinegar, whereas in olden times they were considered good. This has been used as an argument to prove that the climate has changed; a much simpler explanation is that the early Prussians, owing to defective development of the sense of smell, did not know the differences among good wine, poor wine, and vinegar.

Coffee likewise owes its flavor to smell. Boiled coffee has lost its aroma and is merely a combination of sour and bitter. Through unpardonable stupidity pepper is always served ground and consequently odorless. the little German pepper mills being unknown in America." p. 128.

*Of the other knowledge elements of heat, cold, and pain, we have paid some little attention only to pain.

When the substances were solid there was also the added help of muscle sensations, which we have noted when especially prominent, as in jellies.

†Some difficulty was found in avoiding a confusion of terms in view of the fact that taste is used both in the narrow sense as the sensation caused by the contact of substances with the nerves of taste, and in a broader sense as the general perception of a substance which one has when it is placed in the mouth.

In this article we have used taste in its precise and narrow sense; "odor" and "smell" for the sensations due to the olfactory nerves; and "flavor" or "apparent taste" for that combination of sensations of taste, smell, and touch.

§Special credit is due Messrs. Victor G. Pickett, Arthur D. Hall, Samuel H. Wolf, Edward B. Bothe, and Harry R. Beede.

The following students furnished valuable material: Messrs. Emanuel A. Artz, Alfred Blaisdell, Elmer Brace, John Campbell, Harry J. Castle, Albert Dickenson, William Furst, S. H. Green, Lawrence E. Horton, L. Lenhart, M. J. Luby, and J. M. Tirrell; Misses Clemma Buck, Ida England, Janet Gray, Helen Hankinson, Eliza Mc Gregor, Jenny C. Phillips, E. Blanche Smith, Josephine Tryon, and Jessie Wedge.

Many very interesting lines of work were discovered and, tho some of them are rather foreign to our subject, we have not hesitated to note them.

Method of Experiment. The substances tested were taken from our ordinary articles of diet. The subjects upon whom the experiments were tried were the family circles of University students, and were mostly adults.

To attain the object we tried to get rid of smell and sight, thus eliminating the odors and suggestions, by having the subject hold his nose tightly and blindfolding or closing his eyes. He was then given substances and, sufficient time being given them to dissolve and flow over a large part of the tongue, he was required to describe the taste and requested to name the substance if he could. The mouth was rinsed thoroughly between each experiment.*

Smell could not be entirely cut off by holding the nose, though it was effective enough for substances with the average strength of flavor. But if it was a substance with a very strong flavor the subject could sometimes distinguish it by means of the odor which reached the olfactory nerves in spite of holding the nose. For example, two pumpkin pies were made, one from a good rich pumpkin, the other from one almost flavorless. Pieces of these pies were given to a large number of subjects and it was found that in many cases the pie made from the rich pumpkin was recognized, while the pie made from the flavorless pumpkin was never recognized.

In these experiments it was found impossible to eliminate touch, which furnished a clew to many things which would most likely not have been recognized by taste alone. Thus many substances were recognized at once, even before any taste was experienced. For example, butter could thus be recognized as soon as it touched the lips and long before it reached the inside of the mouth at all. It was also found extremely difficult to prevent meats, breads and other substances from being at once known by means of touch. As a result of this inability to remove touch from the field the gain obtained from blindfolding the eyes was sometimes lost, and even turned into a detriment. For as soon as touch enabled the subject to iden-

*There was some difficulty in the descriptions of the tastes, which was due to the poverty of the vocabulary of taste. It was often almost impossible for the subject to describe the taste experienced so that another could grasp the description. Some round-about expression of comparison was perforce resorted to, as that "it tasted something like slate" or what not. This as a rule not only failed to convey the idea of the subject adequately but was liable to give the experimenter a wrong impression. Allowance was made for this.

tify the substance at least approximately, suggestion followed as a natural result. And suggestion has much to do with taste.

Suggestion. In the cases where the subject was enabled thro smell or touch to recognize the substance that was given him the results were not at all satisfactory, as the power of suggestion and imagination interfered too much. Some interesting experiments were made in the endeavor to eliminate suggestion and striking results were obtained tending to show the tremendous influence of suggestion on one's judgments. An attempt was made to carry on a few experiments under a perfect disguise. Advantage was taken of the fact that pastries which contained different fruits tasted alike and could not be distinguished from each other save by the sense of touch, enabling the subject to determine the fruit by the character of the seeds. Apple pie could not be told from rhubarb pie. But the subject could at once distinguish grape pie from ground-cherry pie when the seeds were left in the grapes, but they could not distinguish grapes from rasins (stewed) when the seeds were left in both. They could readily distinguish strawberry from raspberry pie on account of the seeds in the raspberry, but could in no case distinguish raspberries from blackberries. Nor could they, as a rule, distinguish between currant pie and raspberry pie, but a pie was made of currants whose skins were tough and then in experimenting with the two pies the subject readily pronounced one currant and the other raspberry. Two pies were made, one of small plums and the other of grapes, both with pits and seeds removed. Subjects could not distinguish between them. Later these pies were doctored, plum pits put in the grape pie and grape seeds put in the plum pie. The subject at once pronounced the grape to be plum and the plum to be grape pie. In all of these cases the subjects were perfectly honest and actually thought that they were judging by their sense of taste, when nothing could be more evident than that they were judging by their sense of touch. Many interesting examples can be given illustrating how much suggestion has to do with taste and smell. A certain old gentleman rode almost daily along a particular stretch of country road in company with a younger companion who had been experimenting on taste and smell and was on the alert for material. At one point of the road there was the smell of a skunk, very strong and offensive, and it continued day after

day. The old gentleman had lost his sense of smell so that he was utterly unconscious of the state of the air. But one day he noticed the skunk running across the field and he immediately perceived the smell of which he had until then been unconscious. Every time after that when he passed that point of the road he was much annoyed at the smell, even after the taint had entirely disappeared from the air. He was just as sincere in the matter as he could be, for after he had once seen the skunk there, he was sure that he could actually perceive the smell day after day.

Another subject of the same sort was found in a lady who had been thrown from a carriage in a run-away. She struck the back of her head violently on the pavement; as a result of the blow she thought that her sense of taste as well as of smell was entirely gone. But after some months she found that she could taste sweet, sour, salt, and bitter, and this was really all she ever could taste. The truth is that she had lost merely her sense of smell and hence could no longer detect the flavors which are chiefly due to smell. The loss of the power to perceive odors acted as a sort of negative suggestion so that she could not recognize the tastes which she really experienced. In another case a young lady was in the habit of using a certain peculiar perfume. A friend did not see her for five years. When they met the friend at once scented the same perfumery. Afterwards it is found that the young lady has discontinued the use of that perfume for some three years and has used an entirely different perfume.

A number of interesting comparisons were made in trying to get rid of suggestion due to touch. Substances very much alike, as butter and lard, were given one after the other and the subject requested to tell which was which. Unsalted butter was used so that it could not be identified by its salty taste. The two substances, lard and butter, were both tasteless, but the subject was very often able to tell the butter from the lard merely by the touch, the lard being "more compact and oily" than the butter, as one described it.

Cotosuet was added to butter and lard, and was also distinguished, being, it seems, "the most compact and the least oil" of the three.

A piece of rock salt was given to a subject who was very much influenced by suggestion. He pronouuced it salt and said it was rock salt. Soon after in the course of the experiment he

was given a piece of quartz rock of the same size and shape as the rock salt before given. He declared at once that he tasted salt, and it was the rock salt again. Being asked if it tasted very salty he replied that it did taste exceedingly salty.

Thus in many experiments the memory perceptions, associated with the present perceptions, were stimulated to some degree of reality as an hallucination. This process, which we have called suggestion, had to be continually kept in view in all the following experiments in which touch and a possible remaining stimulus of smell could not be excluded.

Sensation of Sweet. A systematic and extended series of experiments was made to determine if sweet was positively and always recognized, no matter in what form or in what substance it appeared, or how much disguised or unexpected. Most satisfactory results were obtained. No matter where it appeared, whether in liquid, candies, or in cakes, the sweetness of the sugar was at once detected, and the substance pronounced sweet.

Clear sugar was easily recognized because of its familiar form. To eliminate this, pulverized sugar was used instead of the more common granulated sugar. In three-fourths of the trials sugar was recognized at once. In the other one-fourth it was always pronounced sweet immediately and was usually suspected to be sugar or "some sort of sweetened powder." Vermont maple sugar was "quite sweet," but was not recognized at all and that pleasing and peculiar flavor, so characteristic of maple sugar, was entirely lacking.

A liquid with sugar in it was at once distinguished from the same liquid with no sugar. Sweetened water, sweetened milk, coffee, tea, cocoa, and the like, were invariably pronounced sweet. These liquids were given during the course of other experiments and the subjects had no expectation whatever of receiving a sweetened liquid.

A large number of sweet substances were tried on many persons with the aim in view of ascertaining whether the sweetness was always recognized. Various kinds of cakes, sauces, preserves, sweet pickles, jellies, puddings, custards, and candies were tried. Cake and fried cake were as a rule confounded, tho recognized as cake. The subject pronounced one the other indiscriminately. That they were recognized at all was undoubtedly due to their sweetness added to the suggestion arising from the touch. Graham crackers were sweet.

Peanut taffy was pronounced "something sweet." A choice caramel suggested a piece of old leather, but was sweet. Clove candy was merely sweet until it was chewed, when it became hot from the cloves. Saffron stick candy was sweet only. In no case was candy recognized as candy save by touch.

Custard, tapioca pudding, rice pudding, bread pudding were sweet, but were not recognized. Apple sauce and most other sauces were sweet. Common stewed prunes were sweet only, but were occasionally recognized by touch. Quince sauce without sugar was slightly sour and puckery, while with sugar it was slightly sour and puckery also, but sweet was the principal taste noted. In one or two cases the puckery sensation was not remarked upon. Raspberry shrub was sweet and sour. Cherry sauce was sweet so far as regards juice alone. A cherry alone was somewhat sour. Cherry juice and stewed prunes were distinguished in one instance by the cherries being the sweeter. More sugar was put into the prunes when the cherries were separated from the prunes by being slightly sour. Preserves were always very sweet and rarely recognized.

Different kinds of jellies were confused unless they could be distinguished by touch in some way, as in the case of strawberry jelly, which was known by its seeds. A jelly was usually recognized as a jelly from touch and muscle sensations. Jellies were sour or sweet, or both, according to the fruit of which they were made. Green goosberry jelly produced various results, running from "terribly sweet" to "sweet and sour." Ripe currant jelly was less sweet and was also sour. Grape jelly was merely sweet. Dried apricots produced "a sweetish acid" taste in one instance. Usually dried apricots were merely sour. Muscatel raisins were very sweet. Dried English currants were sweet and were not recognized. Raisins were distinguished from dried English currants from the greater sweetness of the raisins. Sweet pickles, citron sauce, preserved pears, pared plums, and the like were all sweet, but could not be distinguished one from the other save by touch.

Different kinds of fruit could not be distinguished from each other, but were merely classified as sweet or sour, or both, as the case might be. Dates were sweet without failure, but were not recognized at all. Figs were sweet and likewise not recognized. Banana was occasionally sweet, but was usually tasteless. Grapes with the seeds removed and otherwise disguised

were never recognized. They were generally tasteless, but sometimes sweet or sour, or both sweet and sour. Strawberries were sweet in a majority of cases, but were sometimes sour. The peach produced a sour and sweet taste as a rule, but often was tasteless. Pears and apples were often confused. Peaches and plums, although much alike in touch could be readily distinguished from each other by the sweetness of one and the sourness of the other. Sour apples were sour and sweet. Apples were generally recognized from "the feeling in the mouth," that is, from touch. A good chance was offered here for a comparison of a sweet apple scraped and a scraped raw potato. It was absolutely impossible to tell the two substances apart from touch. Here was an excellent test of the ability to taste sweet. In every case in which the test was made the apple was at once pronounced sweet and was thus readily distinguished from the potato.

Sweet peas were always pronounced sweet. Sweet, sour, bitter, and tasteless fruits, mixed together, gave curious results. Here was an excellent chance to find out how far one taste can overshadow others. For example, cranberry, which was sour and bitter, apple which was sweet, and potato which was tasteless, grated raw and mixed together were given in one instance. "It is grated apple mixed with vinegar" said the subject, thus noting the sweet and sour, but not the bitter. Banana and apple mixed were sweet and called pear. But pear and raw potato were tasteless. Apple and raw potato were slightly sweet. Banana, pear, and apple were tasteless and thought to be raw potato.

Things did not produce the same degree of sweetness in different persons. A few comparisons of sweet fruits that were attempted with the idea of discerning which was the sweetest, utterly failed on this account. Citron, grape, strawberry, apple, and plum were the fruits used. Each one of the fruits was labeled the sweetest at least once. Citron was sweetest once, but was usually "slightly sweet." Grape was "sweetest," "very sweet," "not very sweet." Strawberry was "rather sweet," "very sweet," and once "sour." Apple was "sweetest," once, but generally "slightly sweet." Plum was often "very sweet," and about as often "slightly sweet."

Various experiments were made with a five per cent solution of Gynamic Acid, which, when brushed over the tongue, destroys for several hours the power of tasting sweet. A per-

son whose tongue had thus been brushed with Gynamic Acid could not tell sweet cake from bread. Sugar was tasteless and felt like sand. Syrup and honey were not recognized, nor distinguished from each other. Peanut candy and in fact all substances previously pronounced sweet were now pronounced tasteless.

The fact that sweet was so invariably recognized and noted is of importance. Some thirty different subjects were tested in sweet and not one failed to taste sweet unless under his threshold or disturbed by accompanying sensations. This is worthy of note in view of the exceptions in the other tastes, and is possibly explained by the fact that sweet is best tasted on the tip of the tongue, and is apparently the fundamental taste of mammals at least.

Sensation of Sour. Vinegar was always sour, but was not often recognized. It was pronounced "some acid liquid," "lemon juice," "sour lemonade," and once out of twelve trials was recognized. Compared with other sour liquids, as lemon-juice, it could not be readily identified. However, it could be distinguished from acetic acid. This was very likely due to the difference in the consistency of the two liquids, or else from the different degrees of sourness which they possessed, although an effort was made to dilute the acetic acid sufficiently to make both of the same degree of sourness. Lemon-juice was always sour, but was not often recognized, being commonly confused with vinegar. Orange juice was not recognized in the few trials that were made, but was sour.

Sour pickles were usually distinguished. Cranberries were "sour like vinegar," and usually there was also a bitter taste. Peaches were often slightly sour, tho more often tasteless. California prunes were sour and often slightly bitter. Strawberries were somewhat sour in a minority of cases. Burgundy wine was sour and also bitter somewhat. Raspberry shrub was sour and sweet. In the olive sour was perceived by all of the subjects, but some also detected bitter, and others salt in addition to the sour. Cheese was sour and also somewhat bitter, and was never recognized. There was a touch element in cheese described as "oily."

As a conclusion in regard to sour it may be stated that sour was almost always distinguished without difficulty.

Sensation of Salt. Pure salt was as a rule recognized after some little time. Out of thirty-six trials, twenty-four recog-

nized salt, and the remaining twelve experienced a "salty" taste or pronounced the substance as "something salty." In salt pork a salty taste was noted and nothing else. Dried beef cooked in milk was pronounced salty in the two cases in which it was tried. The salt used in seasoning potatoes was always noted, especially in the case of fried potatoes. Salty cracker were very salty, and pretzels were always salty. Dill pickles were salty, and olives, as has been said, were salty as well as sour and bitter,—the salty taste being the predominating one. Soda was pronounced salt by one who had recognized salt just before. Salt was almost always noted when put into a substance. In liquids, especially, was this true. Occasionally, however, a subject did not seem able to taste salt with much readiness. There do not seem to be any substances that are salty save when salt is put in as a seasoning.

Sensation of bitter. Bitter substances were rare and results were not very satisfactory. Cherry wine was sour and as soon as the wine reached the back of the tongue was usually bitter. In about one-third of the cases, however, there was never any bitter taste at all. Whiskey was probably somewhat bitter, and ale was slightly bitter. Rum was very bitter and beer was more or less bitter, depending on the kind of beer. Burgundy wine was possibly bitter, though often no bitter was noted. In all these drinks there was of course a burning due to the alcohol. Several other substances were bitter to a greater or less degree, depending largely upon the subject. Mustard was bitter usually. Tea leaves were slightly bitter. Tea in its form as a drink was bitter to most persons until the sugar was put in, when the bitter taste seemed largely to disappear. Sweet seemed to have the power of thus driving bitter below the threshold. The same was true with cocoa and chocolate, which was bitter until mixed with sugar. Cheese was occasionally somewhat bitter. Cranberries were bitter quite often and California prunes were sometimes slightly bitter. Celery was rather bitter.

The general conclusion seems to be that bitter is very apt not to be noticed. In some instances the subject seemed almost unable to realize that cherry wine was bitter. Many, indeed, never noted the bitter at all. As a rule, however, the subject would be in doubt. He would ask for another trial before rendering his decision. After a second or third trial he

would be prepared to state quite positively that it was bitter. Thus, then, it is not easily distinguished.

Special experiments with tobacco. A large number of subjects were tried with chewing tobacco. The chronic tobacco chewer who had become accustomed to the burning of the tobacco could not readily recognize it when his eyes were closed and his nose held. Non-chewers usually noted a stinging sensation. The taste was bitter and in most kinds of tobacco there was also a sweet taste.

The experiments with smoking tobacco were of interest. It is commonly stated by old smokers that smoking in the dark destroys the pleasure, especially if one cannot see the light of the pipe or cigar. A number of experiments with smoking tobacco seemed to confirm this statement. The subject was requested to shut his eyes, but he was not to hold his nose. The room was already well filled with tobacco smoke so that the subject could not tell when he was smoking by the odor of the tobacco. Two pipes were used, one being lit and the other unlit. They were filled so that one drew as hard as the other. The pipes were put into the subject's mouth and he was asked to tell when he was smoking at the lit pipe and when he was puffing at the unlit pipe. Many times he could tell by the heat of the lit pipe, but care was taken to guard against this, a new pipe being substituted as soon as the old one was hot. Many times an old smoker would solemnly puff away at the unlit pipe and claim he was smoking. Non-smokers could generally distinguish the two pipes, probably because, not knowing how to smoke they drew some of the smoke into their lungs or nostrils and thus told. There was also a biting sensation on the tongue as the smoke passed through the mouth. This was especially noticeable in strong tobacco.

When the nose was held and smell was entirely cut off, as well as sight, even an old smoker of many years experience and a connoisseur in tobacco was absolutely unable to distinguish a poor and cheap brand, greatly favored by hackmen, from a choice and high-price mixture. Nor could he tell cigars or cigarettes crushed in the pipe from pipe tobacco. As regards the taste of smoking tobacco, there seemed to be a slightly bitter taste, but it was very slight. The pleasure from smoking then, is derived not from taste, but from the odor of the tobacco, the sight of the smoke, and the soothing muscle sensations which accompany the act of smoking. It is likely

that with many of the weaker brands of tobacco the pleasure is almost entirely due to sight.

There was some years ago a "harmless pipe" in the market, the construction of which was based on this idea. It was so arranged that no smoke entered the mouth, but was drawn from the bowl into a receptacle and, when the smoker blew out the smoke which was there, it issued from the opening through a valve near the stem and the illusion was completed. Many habitual smokers claim that the enjoyment was just as great as in the old way.

A very peculiar phenomena was noticed with tobacco and with a few other things. When a non-user of tobacco was given tobacco, with odor and sight excluded, he experienced that sensation of nausea so well known to the beginner of the tobacco habit. As has been said, he could not identify the substance as tobacco, but nevertheless he at once experienced the nausea. No matter on what part of the tongue the tobacco was placed, no matter how minute the quantity, the nausea resulted. This was also the case in smoking and was one of the ways in which the non-smoker distinguished the lit pipe from the unlit one. A similar result was also obtained with fried eggs and with fried cakes. In three cases fried eggs nauseated subjects, though they could in no case identify the article as they ate it. It was found on inquiry that these persons did not like fried eggs and were always nauseated by them. This result was likewise obtained with fried cake. A subject who did not like fried cakes was nauseated when that article was put into his mouth although he did not know what it was. Results of this character were not often obtained, yet occurred often enough to show that there was a physiological action independent of odor and sight, to which nausea is generally ascribed, and interesting enough to induce further experiments.

Tasteless substances. It was found impossible to disguise meats so that the subject would not know what the substance in his mouth was. The sense of touch enabled him to know the substance as meat, but this as a rule was the extent of his ability in this respect. Very rarely indeed could one tell one meat from another and, as to taste, there seemed to be none at all. Mutton chops were tasteless. Warm turkey was also tasteless. A piece of cold turkey was in one case recognized, but most likely this was a lucky guess, as a piece of cold beef

steak given to this same person directly afterwards was also called turkey. He moreover thought "it was a piece off of the turkey's leg, as it was tougher and harder to chew than the previous piece." Cold roast beef could not be told from smoked ham, and both were tasteless. Dried beef in milk was merely salty from the seasoning and not recognized. Chicken was readily identified. One reason for this seemed to be the peculiar fibrous nature of the meat. Endeavor was made to obviate this by shredding it, chopping it, and pressing it, but it was impossible to conceal its identity. Nevertheless many subjects admitted that they could taste no flavor when the chicken was in their mouth, but merely detected an oily taste, which is touch rather than taste. Bread was invariably recognized at once by the well known touch sensation which it stimulates. Crumbled into minute particles it was still recognized. However there seemed to be no taste to bread, aside from the suggested taste which tended to make it taste as usual. Graham bread was tasteless and could not be told from white bread. Dry toast was tasteless and suggested "slate stone." Flour was recognized in one case, but as a rule was tasteless and not recognized. Oatmeal produced no taste at first, but after keeping it on the tongue for a while there was a salty taste, due no doubt to the salt mixed in when cooked. Sulphur was not recognized and was tasteless. Starch was not recognized. The yolk of an egg raw produced no taste, nor did the white. Cooked eggs were tasteless. In the vegetable kingdom our old standby, the Irish potato, was not recognized, especially when in its familiar cooked condition. Nor was the potato recognized when raw, save by touch. Chunks of raw potatoes were described in one instance as "chunks of ice." This was a perfectly natural conclusion, due to the crunching of the potato and its watery nature. However, potato in this form was in one-tenth of the trials recognized. That this was due solely to touch was shown by the fact that grated raw potato could not be told from grated celery, as a rule, though a slightly bitter taste in the celery served to distinguish it in one-fourth of the cases. Raw carrots, raw parsnips, raw beets, and lettuce were not recognized and were tasteless. They were of course described as vegetables, but that was all. Cabbage produced no sensation of taste, but its crispness gave a very plausible clew through sound, touch and muscle sensations, as to the name of the sub-

stance. Raw onions, and very strong ones, were tried on a person who especially abhorred onions in all forms. On this occasion the hated vegetable was immediately eaten, not being recognized at all. There was usually experienced in the case of the onions, especially if strong, a slightly biting or stinging sensation, this being due to touch, of course. Of some twenty persons tried, none were able to recognize onions. Tomatoes were frequently tried, but subjects as a rule failed to identify them. Sometimes they pronounced them figs, an idea resulting from association merely, as the seeds of the two closely resemble each other. Peaches were often pronounced tasteless, as were also bananas.

The common drinks of tea, coffee, and milk and water were next tried and afforded some interesting results. There could of course be no clue from touch of size and form in liquids. Cold tea, cold coffee, and cold water were confused, and apparently could not be told apart. Warm water, warm coffee and warm tea, all unsweetened, could not be told apart in nine-tenths of the trials. Coffee was occasionally recognized and some would identify tea, claiming that it was slightly bitter. The same results were obtained as to identifying the liquids when they were sweetened. The sweetness was noted at once. The bitterness of the tea seemed to be gone almost entirely when sugar was put in. A peculiar fact was noted in that water was almost always identified. Tea and coffee would be called water very often. But it was rarely that water was called tea or coffee, or anything else than water. This may possibly be due to the fact that, since water has neither taste nor smell, it therefore produces the same sensation whether the nose be closed or not. Or, it may be due to the fact that about the first thought that enters a man's mind as soon as he realizes that a liquid has been placed in his mouth is that it is water. Thus, tea, coffee and milk were often called water at once. Water seemed to produce about the same sensation as usual. Milk, when compared with water, was recognized in three-fourths of the trials by means of the greasy sensation due to touch.

Cocoa without sugar or milk seemed rather bitter to most subjects, but was occasionally pronounced tasteless. It was rarely recognized. When in its customary form with sugar and milk, cocoa was sweet, and was not recognized as a general thing. Warm soup tasted very much like water. In some

way however soup was usually distinguished from water. Most probably through touch, by the grease in the soup. Soups were not distinguished as a rule, though in two cases vegetable soup when compared with macaroni and tomato soup, was distinguished. This was most likely due to touch, the vegetable soup in this instance being somewhat more greasy than the other soups. In one-third of the trials with tea leaves there seemed to be no taste at all, and they were called hay once or twice. Ground coffee was not recognized, as that well known aroma which makes coffee so enticing was of course gone. By one coffee was recognized as "chunks of dirt," by another ground coffee as "saw dust."

Spices. A great number of subjects were tested with spices, and it was demonstrated beyond all doubt that it is only when the nose is free and the odor of the spice taken reaches it that the spice can be directly and not inferentially known. Allspice is not as familiar to most people as the other spices and hence was not frequently distinguished. As a rule it gave no taste or sensation of any sort. Occasionally there was a smarting or stinging sensation common to most all the spices. Being thus inferred to be a spice various guesses were made as to its name. Mustard, sage, cinnamon, cloves, and pepper, were suggested. In one case only out of fourteen trials was the guess correct. Cloves gave often a burning sensation and were thus known to be some sort of a spice. Cloves were frequently named without much hesitation,—in fact in more than one-half of the trials was this true. As some thirty different subjects were tested this is worthy of note. It is explained doubtless by the fact that cloves have a very strong odor and it is almost impossible to shut out their smell when they are placed in the mouth. Added to this odor, cloves have a powerful burning effect, distinctively their own, which serves to identify them even more than does their strong flavor. For this reason ground cloves were often guessed to be pepper, which has also a very positive burning effect.

Thus it was that pepper was almost always distinguished, rather than from any taste that it may possess. It produced a very marked sensation described as biting, stinging, smarting, or burning. It was at once known to be a spice from this, but was not distinguished from other spices. It seemed on the whole simply to feel hot in the subject's mouth. However, it did not burn so much when the nose was held closed as at

other times. This was perhaps because its odor ordinarily adds to its burning effect by being of an acrid character. Pepper was occasionally pronounced snuff or tobacco, and snuff was, as a rule, pronounced pepper.

Cinnamon produced a very slight stinging sensation of touch in some cases, which may have been due somewhat to suggestion in that the subject guessed that he was tasting some sort of spice, Very many reported no stinging sensation.

Cinnamon was almost always sweet—very sweet. In fact it was so sweet in one case as to be called sugar. It was sometimes recognized on this account, being the only spice certainly having a real taste. Four persons out of the twenty upon whom cinnamon was tried thus recognized it at once. Ten merely reported it sweet. In six cases, however, it was tasteless, but in these the threshold of sweet was comparatively high.*

Nutmeg seemed to produce no sensations of taste, though possibly it did of touch, as it was guessed to be cinnamon, cloves, allspice and, once or twice, nutmeg. Usually, however, it produced no effect whatever. Mustard produced the stinging effect, though rather a sharper, more pungent sensation than in the other spices. It was recognized about half the time probably for the same reasons that were given in the case of cloves and pepper. Mustard was often called pepper. There was, in many cases, a distinct, bitter taste, but quite as often it was tasteless, and no bitterness was noticed. Horse-radish produced much the same results and was not distinguished from mustard. Ginger was recognized but once out of twenty-five trials. As a rule it was thought to be pepper, "weak pepper," or "somewhat like pepper." This was so in sixteen of the trials. It was called mustard occasionally and seemed to produce a very strong burning sensation.

Sage when given in the powdered form was tasteless and in no case detected. When taken in the leaf it was usually pronounced tasteless, often described as hay. The most puzzling trials were with a couple of gentlemen who announced that the substance was bitter beyond a doubt, and one said that it

*Cinnamon has been given by several authors as tasteless, and as an example of the great influence of smell. We have already quoted the passages from Martin's "Human Body," and Scripture's "Thinking, Feeling, Doing," bearing upon this. See pp. 118, 119.

See also Cornhill Magazine, Vol. 50, p. 629, where cinnamon is given as tasteless. If anyone will take the trouble to try cinnamon upon himself he will be easily convinced of its sweetness, unless he is an exceptional case.

was slightly stinging. As this was a new feature and had been noted by none of the other eighteen subjects it was apparent that something was wrong. An inquiry resulted in the discovery that the two gentlemen had been using tobacco just before the trials were made, and in spite of a thorough rinsing of the mouth this after-taste lingered on. This shows the necessity for care in guarding against all such after-tastes.

Flavoring Extracts. Experiments with flavoring extracts have been very popular and can usually be cited as examples which demonstrate in a marked way the absolute incorrectness of the common notions in regard to the power and importance of the sense of taste. Almost all the flavoring extracts that are now on the market were tried. The experiments were carried on in the laboratory upon students by the writer himself, as it was found that experiments in this line were few in number and largely confined to the more common extracts such as vanilla and lemon.

The extracts used were of the best make that could be purchased. We also had on hand a supply of cheap extracts which were used for purposes of comparison with the better makes. By means of a pipette a few drops only were given each time, just enough to cover the tongue. After each trial the mouth was rinsed out and the pipette washed thoroughly to avoid all mixtures. As soon as the nose was loosened the flavor was almost always recognized at once without difficulty.

In each case there was a burning sensation due to the alcohol in the extract. This burning sensation varied somewhat in degree, being very intense, for instance, in banana extract, and very slight in rose and onion. It also varied in character, being sometimes described as a smarting sensation in such an extract as lemon.

Alcohol was given several times to each subject during the course of the trials and was pronounced tasteless and as causing a burning sensation, which was slight compared with the burning caused by some of the extracts, but was of a similar nature.*

Those extracts concerning the taste of which there was, after several trials on each person, a general agreement were easy to deal with. Especially was this true of those extracts which were always pronounced tasteless, as for example, pep-

*This was tested by one of our students, Mr. F. W. Emmons, as follows:
This I found to be true to a greater or less degree in all the extracts with which I have experimented. After separating I tried with three or four persons, which of the

permint, violet, and celery. Also with such extracts as cinnamon which was sweet to almost every one, or with vanilla in which the bitter was always noted, there was but little trouble in reaching a conclusion. But with such an extract as onion, which was sweet to some and tasteless to others, and sour to still others, there was more difficulty. Such extracts about which there was so much difference were tried many times on each subject and an effort made to harmonize the various reported tastes.

To take up the experiments with flavoring extracts in detail: vanilla afforded interesting results. Two sensations were experienced, that of sweet and that of bitter, the latter being often not noted. There also seemed to be to some a sour taste, mingled with the bitter and sweet, and there was perhaps a puckery sensation described "like choke cherries." It is probable that there was a combination of tastes here which it would be very interesting to differentiate. Cheap vanilla also gave the various mixtures of sweet, bitter, and sour in all cases.

Though tried upon a large number of persons vanilla was never recognized.

The fruit extracts were not recognized, nor was there a taste of any sort to most of them. In all cases there was of course the hot or burning effect due, undoubtedly, to the alcohol in the extract.

Strawberry extract was not recognized and was tasteless. In one instance a sour taste was noted. Raspberry, as a rule, was tasteless. In one instance a sour taste was noted even after repeated trials. In others there was a sweet taste. Generally, however, raspberry was absolutely tasteless.

Banana produced a very excessive burning and that was all. There was no taste.

Pear flavoring extract was either tasteless or somewhat sour and possibly, at times, bitter. Rarely it seemed slightly

two burned the most, the extract with the alcohol, or the extract without the alcohol. I found that all agreed that the extract gave the least burning sensation without the alcohol; none knowing which of the two I was giving them to taste. The following are the results I obtained:

	Per Cent. of Alcohol.	Nat. or Art. Extract.	Burning with Alcohol.	Burning without Alcohol.
Banana	80	Art.	Very	Moderate
Rose	70	Art.	Slight	Very slight
Orange	70	Nat.	Moderate	Slight
Onion	—	Nat.	Slight	———
Celery	85	Nat.	Very	Moderate
Violet	80	Art.	Moderate	Slight
Peppermint	85	Nat.	Very	Moderate, after a time burning.
Jamaica Ginger	85	Nat.	Very	Moderate, after a time burning.

sweet. Extract of peach was sweet, if there was any taste. It was sweet as often as it was tasteless.

Pineapple was possibly a little sour, though generally tasteless. Orange extract produced a very moderate burning sensation. There seemed to be a weak taste of some sort which was often not noticed. Careful observers, however, were unanimous in declaring that there was some kind of taste. It was called sour, as a rule, though some thought there was also some little sweet. "Something like a peach stone," was suggested by one. It is likely that there was a mixture of tastes of some sort, probably sour, sweet and bitter. Orange was, however, not recognized at all.

A cheap make of orange extract was slightly burning in its effect, and was tasteless, as a rule, though occasionally somewhat sour.

Lemon extract was usually sour. Very often, however, this sourness was not noted. There was the usual burning sensation. Cheap lemon extract produced no effect whatever, save the burning sensation, and was never pronounced sour.

Onion extract was never recognized. It did not burn as much as the other extracts. Apparently there was some sort of a taste, hard to describe, but seemingly somewhat sweet and possibly bitter.

Celery caused a strong burning, and was absolutely tasteless.

Almond extract was very slightly sweet in most cases. To some, however, it was tasteless. An essence of bitter almond was tasteless in all cases, and no sweet was apparent.

Pistachio was tasteless and burning.

Sarsaparilla gave no taste whatever, save to one man who "thought it was a little sweetish and a little like borax."

Peppermint caused an excessive burning as was to be expected; of taste there was none.

Extract of rose produced a slightly hot effect and this was about all, though some thought there was a little sweetness, but on further trials on the same subjects the sweet was very apt not to be noticed. It must have been at most very slightly sweet.

Cheap rose was hotter and that was all, generally. It was never sweet. Once or twice it was pronounced sour.

Violet produced a very intense burning but no taste.

Several of the extracts of spices were tried and the results

were similar to those obtained with the experiments with the spices themselves.

Cinnamon extract was sweet in almost every case. Occasionally a subject would be found who tasted no sweet, but usually the sweet was strong, so strong indeed that in one case, after several trials, cinnamon extract was thus recognized. Extract of clove caused such a decidedly biting sensation as to distinguish it from all the other extracts. There was no taste.

A cheap extract of ginger produced much the same effect as the best Jamaica ginger, as both are absolutely tasteless, but have a very strong burning and stinging effect which is as powerful with the nose held and eyes closed as it is with those organs free.

Astonishing individual peculiarities appeared in these experiments with flavoring extracts. The threshold of sweet, for example, was very high in one while his threshold of sour seemed very low. In another sweet was always noted, however minute, while sour was rarely tasted. The former tasted sour in vanilla as well as sweet and bitter. No other subjects ever remarked on any sour taste in vanilla.

Lemon was also sour, as was orange, pineapple, pear, banana and raspberry.

To the second subject lemon was sweet or tasteless, pineapple, banana and raspberry were tasteless. He also tasted sweet in almond, sarsaparilla, peach and rose, while to the first subject the four extracts were tasteless.

The general conclusion to be derived from these experiments with flavoring extracts may be summed up briefly. Almost all flavoring extracts are absolutely tasteless. A few did have a taste, usually sweet or sour, and occasionally, but not often, bitter. It is likely, in view of the great differences noted by different individuals in the taste of some of the extracts that there is a mixture of tastes. The finer grades of high priced extracts produce much the same effect as the cheaper ones as far as regards taste, their superiority lying in their better or stronger odor. Thus, then, very few flavoring extracts could be distinguished or recognized even inferentially by taste alone.

Conclusions. From all the foregoing experiments several inferences seem to stand forth prominently. 1. Having eliminated sight and smell, together with the attendant suggestion, and having deducted the touch elements, there remain usually

the four fundamental tastes of sweet, sour, salt and bitter. 2. The power of perceiving these four fundamental taste sensations is not the same. Sweet is most easily and invariably recognized under all and every condition. Sour comes next and is closely followed by salt, which was occasionally not detected in peculiar, unexpected combinations. The experiments with bitter were not as extensive as with the other three tastes, but it was evident that bitter was not very readily recognized. 3. Individuals differ in their thresholds to each of the four tastes; what was quite sweet to one was not sweet to another. In sour the difference was not so marked, but existed, as it did also in salt and bitter. 4. Our perceptions of the various things we eat are greatly influenced by suggestion. It is remarkable how much one will honestly claim he tastes or smells, when, as a matter of fact, it is all due to suggested associations. 5. The sense of taste is greatly influenced by touch. 6. But the most important, conclusive, and interesting result was the clear evidence obtained that almost all our so-called "tastes," or properly flavors, are due to smell. We have thus been acquiring a considerable part of our knowledge and pleasure-pain in very different way and by means of a very different sense than we supposed. This is worth pondering upon and suggests an interesting inquiry as to whether this is not likely to be the case in other lines of knowledge and feeling.

ROY W. TALLMAN.

Postscript. When now one compares these tastes with the chemical constituents of our foods (as in Parke's Practical Hygiene, Nutter's 8th Ed. London, 1891, pp. 246 and 247), it appears that, as combined in food products at least, the nitrogenous group of the proteids, the group of the fats, and the starch among the carbo-hydrates gives us no taste, but only smell; the dextrine and sugars of the carbo-hydrates gives us the sensation of sweetness; the vegetable acids give us sour; and the mineral salts give us salt.

How we come to have pleasure in these three tastes of foods appears to be another case under our general biological principle of pleasure-pain, whereby stimuli which on the whole are beneficial to us become pleasurable and the harmful stimuli become displeasurable or painful. The infant has acquired an instinctive perception of difference of sweet from other tastes and a liking for it from its being the only taste element in its natural food of mother's milk. So if cow's milk is used

some additional sugar has to be added. By psychological diaries and experiments on our three children, Mrs. Gale and I found that during the first year a sweet solution was the only one of the four tastes which the children would take and swallow. As its diet began to enlarge in variety during the latter half of the second year, the child would take salt, and in the latter half of the third year it came to like a moderate sour.*

Thus it appears that in our evolutionary development we have acquired an hereditary pleasure feeling attached successively to the perception of sweet, salt and sour; and this feeling of pleasure matures or shows itself at about the time when the food substances having these tastes become advantageous or necessary for the welfare of the body. (Cf. Parkes' Hygiene, above. Also Foster's Physiology, 6th Amer. Ed., pp. 245-6; Martin's Human Body, Advanced Course, pp. 299 to 307.) But in the case of the taste of bitter it is very doubtful whether this ever becomes a naturally pleasureable taste as an instinct from its serviceableness. For I have not yet found evidence of children's thus coming to like bitter naturally, and there appears to be in our necessary food no chemical elements which have a bitter taste. The acquirement of pleasure in bitter tastes, as in coffee, tea, beer, some wines and other alcoholic drinks, seems to be a case under the other pleasure-pain principle of habit or custom, by which the persistence in any originally indifferent or unpleasant stimulus comes to be finally pleasurable, provided of course the stimulus is not harmful enough to kill the organism. As a stimulant for an extra exertion of the digestive and nervous systems and for other medical use in pathological conditions there is undoubtedly cause for our enduring or even perhaps coming to like bitter.† But for the normal body this natural dislike of bitter seems to be an evolutionary sentinel, warning us of extravagance or harm, and so giving more scientific evidence for the cause of temperance.

H. GALE.

*The following is a sample of the periodical tests made on the children. S. male, 32 days old. Solutions warmed to normal food temperature and given before feeding. Tongue wiped after each trial.

Quinine, 1-64000, questionable reaction.
Salt, 1-320, no movement of the tongue, or effort to swallow.
HCl, (sour), ditto.
Water, swallowed.
Saccharine, 1-6000, swallowed.
Salt, 1-80, remained still; no effort.
Sugar, 1-40, swallowed eagerly.
HCl, 1-1600, indifferent and not swallowed.
Quinine, 1-128000, began to swallow and then made face.

†As in the group of vegetable bitters in materia medica. See e. g. Butler: Materia Medica, 1899, pp. 172-181.

A CASE OF ALLEGED LOSS OF PERSONAL IDENTITY.*

On the 14th of October, 1896, a gentlemanly and intelligent Englishman about fifty years of age, walked into Mankato, Minnesota, and registered at the City Hotel as "John Harrison, St. Paul." The expenses of lodging and breakfast having exhausted his money, he left the hotel the next morning and wandered about town all that day and the following night. He kept on the outskirts of the town, fearing an arrest from the police. During the night he assisted to his home a drunken man to whom he later returned a pair of shoes, which he feared to have found in his possession. The following morning he returned faint and weary to the hotel, told the clerk he had no money, and offered his umbrella as security for breakfast. He then inquired for the Episcopal Church, and thus found his way to the Rector of the church, Rev. Geo. H. Davis, to whom he said he could not recall his past life. He knew he was a churchman, showed an Episcopal prayer book, recalled having presented some girls from his Sunday school class for confirmation at some Easter two or three years ago, had been in the habit of acting as lay-reader somewhere, and had perhaps been in the furniture business. He knew, however, that his name was not Harrison, though he could not recall his real name. Beyond these facts he said he remembered nothing, could not tell whence he came into Mankato, except that he walked by a bluff and across a bridge into town. His consecutive memory broke off at that point two days before. Having asked to be directed to a physician, Mr. Davis took him to Dr. J. W. Andrews, corner of Cherry and Second streets, to whom alone he told the same story. He was then further sure that his wife and children were dead, that he had lost his valise and pocket book, but did not know where or when. He thought he had left home several weeks ago, had had means, had been in Winnipeg, was engaged somewhere in business for himself, and that this is the first attack of the kind he had had. He said he never tasted liquor and was in apparent good health. So he was taken to the hospital to await the probable recovery of his lost memories. A week after his admission,

*An abstract of this case appeared in the Proceedings of the Society for Psychical Research, Feb., 1900, Vol. XV, pp. 90-95.

hearing of the cyclone at St. Louis, he said he recalled something how that injury looked. Acting on this suggestion, Prof. C. F. Koehler, Psychologist at the State Normal School at Mankato, gave him a railroad map. This he scanned until he came upon the Mobile and Ohio railroad, which seemed familiar to him. Following this along he came to Fruitdale, Ala., where he then recalled having been in the lumber business. After this experience he called on Mr. Davis and seemed very happy at being on the track of his identity. Shortly before this he had, with some apparent effort, recalled the name of Blanchard, Chamber of Commerce, Chicago, with whom he had been in business. Through Dr. Andrews he had written him, telling him of his loss of identity and asking for help. Mr. B. replied that he thought he recognized the man from Dr. Andrew's description and would come from Chicago to see him, whereat he was happily excited. On Nov. 5th Mr. Blanchard came, was gladly received by his former business associate, who now recalled the saw mill and most of the people in his employ. On Mr. B.'s telling him that his name was John Hardcastle Hall, he then for the first time recalled that it was. He could not remember when he left Fruitdale, or Mobile, but did recall being in Chicago in June. Only pleasant recollections seemed to return to Hall as he chatted and chuckled along with his former business friend.

Mr. B. now accused him in severe terms of all his dishonesty and threatened him with arrest. But to "liar, forger, embezzler, defaulter," etc., Hall only listened in a dazed way and with a surprised and hurt expression. He knew nothing of the $400 drawn in Mobile, nor of the $300 borrowed there, nor could he account for some $2,300 sent, more than to think he must have paid it out. He asked why he should have been so anxious to send for Mr. B. if such things had occurred and he was liable to be prosecuted.

Later in the day Mr. B. gave Mr. Davis, Dr. Andrews and others interested in the case the following account of his connection with Hall:

"I first met Hall about a year ago. As I afterwards learned, he walked into Fruitdale, Alabama, penniless, as he came into Mankato. He secured a lease of 10,000 acres of pine land, and went to work to interest capital in his project of starting a saw mill. He got four well-to-do farmers interested, and as a guarantee of good faith asked them to sign notes of $25 each and deposit them with him. This they did, and he then walked forty miles to Mobile, got the notes discounted at a bank for $90, and then started north to get machin-

ery to start his mill. While on the train he read an advertisement of some saw mill machinery for sale, which I had inserted in a newspaper. He came into Chicago and found me and made a proposition that we go into business together, he to stake his lease against my machinery. He presented many references of the best kind, some from Episcopal church clergymen. I saw some of these parties and found they had known Hall in years past, but for six or seven years after these references were given there was a gap. He claimed to have been in business in North Carolina and at Shenandoah, Va., during that time his wife having died at the latter place. He claimed to have purchased a tract of timber and to have been swindled out of it. He also failed in business at Dallas, Texas, but that failure was straight. Despite this gap I was favorably impressed with the man and decided to risk it. I am naturally suspicious, but no man could fail to be impressed favorably with Hall

"Well, the machinery was started and a force of men employed. I did not visit Fruitdale, but Hall made monthly reports to me. He sent every month to me what purported to be his cash book. They were models of beauty, ruled up with red ink, and showed the amount of money I sent him, and how he had disposed of it in paying the men. But I afterwards found out that he kept no cash book, and manufactured out of his head what he sent me. For example, the April pay roll was $425, and on one side he had this sum received from me, and on the other side the amounts paid to the employes exactly balanced it. But he had not paid a cent to the employes, but had given them orders on store keepers at Mobile for the amounts and had not paid the store keepers. This continued four or five months.

"Hall was industrious to a high degree, feverously active, the first at the mill in the morning and the last to leave, always going here and there but accomplishing nothing. He was not a good business man, yet the business would have been successful had he acted squarely. He was a master of lying and forged letters, and carried on a systematic course of deception. He did petty thieving when he could have gotten more from me. He forged a letter purporting to be written by one Slater to himself, saying that the writer had $1,500 to invest and would give it to Hall to use in the business if he (Slater) could have a position. I was led to believe that this was done, and that Hall had put the money into the business; yet I afterwards learned that the letter was a forgery and not attempted to be an imitation of Slater's hand writing. Slater was a common deck hand on a boat and had no money, but Hall gave him a good position to keep up the deception, but did not pay him anything. Hall put no money into the business.

"The fore part of June, Hall went to the state line and bargained for a lease of another large tract of timber land. He had a project to erect a hotel, a barn and a town site, and agreed to pay for all this in his own name. He then came on to Chicago and told me what he had done and said that he had as good as made $50,000 by the deal, and offered me a half interest. I laughed at the plan, but he was in earnest. He went back south the next day.

"Hall's non-payment of his men and the store-keepers began by this time to make them clamorous for money, and he came back two weeks later and wanted money. I had none then, but told him to go back to the state line and I would telegraph him $400 then. This was done. Hall got on the train for Fruitdale, and when the train arrived there the laborers were on the plat-

form, demanding their money. The foreman rushed in and said that the men were highly excited and that they must be paid. Hall coolly took from his pocket a big roll of bills and told the foreman that he had more than enough money to pay every man. He then took from another pocket a big package of what purported to be bills and handed it to the foreman, saying there was the exact amount to pay the men. The foreman took the package and got off just as the train was pulling out. He found on examination that the package was merely paper cut up and shaved down to the size of bills and wrapped in paper.

"Hall went on to Mobile that night and borrowed $300 from a friend and then disappeared and has never been seen or heard of since until I met him today. He wrote to me on June 17th on stationery of a prominent Mobile hotel, where he was not stopping, saying that he was feeling sick that day, and that "the mental strain and worry of the last fourteen days has almost broken me up." This was the day that he disappeared and the last that I ever heard from him. He got about $10,000 of my property on a tissue of falsehoods. I had sent the man about $500 a month to meet the pay roll but he had disbursed none of it, but drew the money himself and paid the men in store accounts and then didn't pay the merchants. There was about $8,000 due the merchants. I was never able to find any trace of the money or books and don't know how Hall left Mobile or where he went. I had a detective at work on the case for a week, but he was unable to learn anything regarding the man. Hall must have taken $2,000 in cash with him. The business has since gone to pieces and the creditors have taken everything in sight. There were attachments amounting to more than three times the value of the property.

"Hall was the reverse in his habits of what a defaulter usually is. He was frugal and stingy, but his habits were correct and he never tasted liquor. At Chicago, if I did not invite him to my house, he would go to a twenty cent lodging house and a ten cent lunch counter. He does not act differently now from what he did when I knew him before. There is the same timid hesitancy in his bearing. He has gained fifteen or twenty pounds in weight since he was in the south. Although he was a systematic embezzler I shall not have him arrested or prosecute him as I do not care to be revengeful and he has no means that I know of.

"His is a most curious case. I don't think that he was crazy during the six months that he was in business with me, and I am at a loss to know whether he is feigning his present condition. If he is, which I think probable, he may have sent for me on account of being oppressed by the fear of arrest. He can remember the good that he has done and forget the evil, for he seems not to remember his bad deeds in Alabama. He sent stock certificates to me as security, all that he had to put up, but they were of no value. He has no relatives that I know of except the widow of a dead brother."

—*Mankato Free Press.*

In a final private conversation with Hall the following day before returning to Chicago Mr. B. talked very kindly, offering to forget the past, and to furnish Hall with money to go wherever he wished to make a fresh start if he would only tell Mr. B. what he really knew. At this Hall broke down in tears

and sobs, but could recollect nothing more and could not accept the offered assistance.

Shortly after recalling the name of Blanchard, Hall had recalled that of W. P. Stuart, in whose office at Fruitdale, Hall had for six months had desk room. In reply to Hall's and Dr. Andrews' letters Mr. Stuart wrote Hall in most friendly terms, and invited him to return to Fruitdale in the hope of saving some of his property. To Dr. Andrews he wrote as follows:

FRUITDALE, ALA., Nov. 4th, 1896.

J. W. ANDREWS, M. D.,

Dear Doctor:—I am in receipt of yours of Oct. 31, enclosing letter from John Harrison, whom I am fully satisfied is no other person than John Hardcastle Hall, whose name appears above as J. H. Hall, treasurer. Mr. Hall was in a prosperous way here, just starting a very fine saw mill, box factory, etc., probably all told an outlay of $15,000. Of course a man carrying on such an undertaking these close times for money, he became somewhat involved, but not so much in my opinion but what he could have pulled through, but as soon as he turned up missing then it was a signal for all his creditors to pounce down upon his property here, involving much litigation and destruction of his property. I have done all I could to see that all attachment cases put up a good bond. Christian & Crofts, merchants of Mobile, in my judgment, have had no just cause for an attachment, but by some hook or crook got an order of court to take possession of all the mill machinery, which they have taken from the mill and loaded it on cars and shipped the last car away yesterday. Hall was interested with Chicago parties who have suffered from this absence of Hall. I have sent them copies of your and Mr. Hall's letters and you may see some of them in your town soon. Try and impress upon Hall the importance of not doing any business transaction with anyone until he has a talk with me. I deem it important that he should come here at once or at least after he consults with his Chicago people, whom I am satisfied you will hear from or see soon. Will feel pleased to hear from you and Mr. John Hardcastle Hall upon receipt of this. As I say, I am about the only one who has stood up for him through thick and thin, for I am convinced he is an honorable man, and has been very much wronged in his business affairs here since his departure.

Yours respectfully,

W. P. STUART, Sec. Fruitdale Land Co.

This letter is written upon stationery of the Fruitdale Canning Co.; incorporated 1896, with a general office at Fruitdale, Washington Co., Alabama, 54 miles north of Mobile on the Mobile & Ohio railroad. The officers of the company are G. K. Keill, president; W. P. Stuart, vice-president; J. H. Hall, treasurer; H. D. Wing, secretary.

A few days later the following letter was received:

WINONA, MINN., Nov. 11, 1896.

DR. ANDREWS,

Dear Sir:—I have just read in the Minneapolis *Tribune* of the 9th, an account of one John Hardcastle Hall, who is or was in your city and claims to have lost his memory. I left my home here in the latter part of March last

and went to Fruitdale, Alabama, under contract with Mr. Hall to superintend the placing of the machinery in a saw mill being built for the Fruitdale Lumber Co., John Hardcastle Hall, president and general manager, John W. Blanchard, of Chicago, secretary and treasurer.

I took charge of the work on April 1st and continued in charge until the evening of July 1st, when I was relieved by the sheriff. I was intimately associated with Mr. Hall for about three months, and will say that while he was somewhat eccentric, I never noticed anything in his actions that would lead me to think he was not sound mentally. [Here follows a good description of Hall].

Will you kindly advise me as to what has been done in his case, as I am fully convinced he is the man I knew in Alabama, and having been so closely associated with him, I would very much like to see and converse with him.

Truly yours,

P. A. Morehous.

Then in response to a notice which Mr. Davis inserted in a church paper came a letter from Rev. Edward Wickens, of Dallas, Texas, giving Hall a good character and referring to the seven girls whom Hall had presented for confirmation at Easter, '95, to Hall's deceased wife, and to Hall's being temporarily insane at Ward's Island, and calling himself John Harrison. A lady in Dallas also wrote Hall, expressing her sympathy for his unfortunate condition and referring to the good work he had done in the church there. Hall admitted the temporary insanity, and in response to inquiries the following letter has since come:

State of New York—Manhattan State Hospital, March 22nd, 1898.
Harlow Gale, Esq.,
Instructor, University of Minnesota,
Minneapolis, Minn.

Dear Sir:—I beg to say in reply to your inquiries that on the 27th of August, 1895, a patient named John Harrison, alias Hall, was admitted to this hospital. The patient was discharged before I assumed charge here as Superintendent, and therefore I am unable to give you any information derived from personal observation. He was discharged Nov. 12th of the same year, and sent to Dallas, Texas, where his parents lived [?]. It appears from the records that correspondence had been had with Rev. Edward Wickens of Dallas.

The records further show that the patient, upon admission here, was dull, depressed, and could give little information of himself, except to state that he had been in New York City a few days. It also appears that he was much confused. When released he had recovered from his depression and physical inactivity.

Very truly yours,

Percy Bryant,
Medical Superintendent.

This former condition, resembling his present, except with only a few days loss of memory, occurred then shortly before

the starting of the Fruitdale lumber scheme in which he interested Mr. Blanchard.

Next came the following information in the *St. Paul Dispatch:*

"Seattle, Wash., Nov. 18th. John Hardcastle Hall, who swindled John W. Blanchard, of Chicago, out of several thousand dollars on a lumber mill deal, and who is now in Mankato, Minn., regarded as either a rogue or an imbecile, has had a long criminal record. He came to Seattle about five years ago and became a member of fashionable St. Mark's Episcopal Church, and secretary of the Skookum Box Factory. In Nov. 1893 or 1894, some California people visited the church. When they returned home they wrote to the rector that they had been ushered to seats by one of the greatest rogues in the country. Hall confessed that he was from San Quentin, and fled. He said he had been imprisoned until recently."

Later the *Post-Intelligencer* said that Hall upon his arrival in that city gave it out he came direct from North Carolina and stated that he had a number of wealthy friends who would back him in any enterprise he might undertake. The story is told of how he got control of the Skookum property. He is said to have represented to the owners of that concern that his wealthy backer would come to the front with the money to pay for the stock, but the money they longed for never came. Hall by various and divers shifts and turns managed to keep the thing going. He is referred to as a hustler, and the amount of work he turned out was enormous, and if it had not been for the fact that his California prison record was shown up, Hall might have been in charge of the mill to this day. Soon after Hall's appearance in Seattle he joined St. Mark's Episcopal Church and became very prominent in the congregation. He was at the head of the St. Andrew's Brotherhood. Then came the exposure. Rev. David C. Garrett, Rector of St. Marks, interviewed Hall, who confessed to having been an inmate of the prison. He was told that he could remain in the church congregation but must resign the offices he held. Hall agreed to this and after shaking the rector by the hand left his presence. The following morning Hall did not show up at the mill, neither was he at his lodging. It was whispered that he had decamped with a large sum of money, this proved to be untrue. His books were all straight and a few hours before his departure from the city he collected $200 from one of the mill's patrons, which he turned in to the company. While his unpaid bills were numerous they amounted to but little in the aggregate. The *Post's* article is more fav-

orable to Hall than against him. He defrauded no one in Seattle.

Hall's own memory and explanation of these events were given the Mankato *Free Press* as follows:

"He served a term in San Quentin prison, California, and claimed that his conviction was secured on trumped-up charges. The story of this affair is one of the matters which he is particularly anxious not to have made public, although if his statement regarding it is true, he was the victim of a deep-laid conspiracy. After his release he went to Seattle and started a box factory, as related in the Seattle dispatches. He did not defraud a cashier out of $7,000, or get ahead of any body but, on the contrary, sunk all of his own funds. He was in this business when the hard times came on in 1893, and time to make payments which had been promised him was cancelled. At the same time a party who knew of his imprisonment at San Quentin demanded money of him and threatened to expose him if it was not forthcoming. He refused to pay the blackmail, and the man wrote to a number of Seattle people saying that Hall had served a term at San Quentin. This and the hard times wound up his business career at Seattle, where he had been moving in the very best of church and social circles, so he says.

"'One of the things that I regret,' said Hall, 'is that I did not, when I went into Seattle, tell of my having been in prison in California. I could have convinced the people in the former city that I was not in the wrong but was an object of persecution. I would have been saved the disgrace of an exposure and my pride would not have been wounded. Again the church people would not have insisted upon my taking a prominent position in religious circles. I made a mistake, but I hope it is not too late to retrace my steps, and if given an opportunity will show that all that has been said in the papers is not true. So far as the general public is concerned I do not care what opinions they may have of me. To those who exhibited substantial sympathy toward me while in Mankato, I told of what transpired in Mankato and California before the account appeared in the newspapers. My conduct here has been such as to convince anyone that I am not so bad as painted.'"

After the Seattle events Hall went to Dallas, Texas, and started in business, and one day a man who knew of his imprisonment came to Dallas and demanded money to keep still. This man got so much blackmail from Hall that the latter was finally obliged to cease paying, and the fellow exposed him. In a letter of Aug. '98, from Rev. Edward Wickens in reply to my question whether there was really any such man who blackmailed Hall, he knew of none and could only say he had "every reason to believe that Mr. Hall was in constant dread of blackmail." His judgment at this time on Hall was that he "was one of those unfortunate men who go on remarkably well for years and then for a time wallow in the mire. I came to this conclusion thro a conversation with a gentleman who roomed next to him a few weeks before his flight from Dallas. He was

remarkable for his chaste conversation especially about the other sex, also for being very temperate in drink. This gentleman stated that all this suddenly changed,—his conversation about the other sex was foul, and he would be under the influence of drink. In my presence he was always all that could be wished."

Hall then went to other places, but the continued fear of having his prison record exposed, and his bad luck in business on this account, led to his mind becoming unbalanced. He then went to the Insane Hospital at Ward's Island, N. Y., where he was restored to health. He did not return to Dallas altho friends there offered to pay his expenses. He made several ventures and then turned up at Fruitdale.

It was now five weeks since Hall turned up at Mankato, and he said that his memory of the preceding four months had entirely returned. "He denied that he had left Fruitdale with several thousand dollars last June and said that he had possibly $300 or $400. His disappearance was due to his mental unbalance and he had not defrauded anyone, paid workmen in imitation bills, or left them unpaid, as had been claimed. He said that not over a carload of lumber of his mill had been sold, as the stock had been kept on hand to season, and there was a large amount ready for sale. He said that it would be useless to return to Fruitdale as nothing could be saved from the wreck. After leaving Fruitdale he had wandered from city to city, had gone around the lakes, visited Winnipeg, and reached Mankato just as his money gave out. He then first realized his true mental condition." "It will be remembered," he said, "I did all I could to discover my own identity. It was I who thought of Mr. Blanchard and hastened to write him. If I am guilty of what he charges me, why should I have been willing to let him know of my whereabouts? He trumped up those stories to square himself with the people he represents. He had a mortgage on all the property I possessed, and if he was a shrewd business man he certainly need not have lost a dollar on my account."

A week before this time of his alleged complete recovery of memory, a traveling professional muscle reader and hypnotist had persuaded Hall to allow himself to be hypnotized to aid the recovery of his memory, but on coming to the appointment at Dr. Andrew's office, in the midst of his befrienders and in

spite of promises that any detrimental discoveries would be kept confidential, he practically refused to submit himself to the hypnotist. But a week later he was willing to allow me to try hynotism with him, so I went to Mankato on the 19th of November.

Hall then thought himself about recovered; but in my first interview with him he could give only the following meager outline of his wanderings since his disappearance from Fruitdale on June 17th. He remembered going to St. Louis and Chicago for a few days each, thence by steamer four or five days through the Sault St. Marie, the large locks there, to some place like Port Arthur. Thence by the Canadian Pacific to Winnipeg. From thence a man whom he had met on the steamer took him driving to see the country at Prairie Portage, sixty miles west of Winnipeg. (Struggling with Portage, confounding with Rat Portage).

Then back to Winnipeg for the second time; thence by the Northern Pacific, probably, to a city where he early recollected hearing a sermon on the Russian Greek Church. This place was identified by means of this sermon as St. Paul, but he could not tell where he stopped there. Thence to St. Peter by rail, probably; stayed part of the night in a Fire Engine House there, and thence walked to Mankato.

He then volunteered an account of his California timber and prison experience, the Seattle affair, the persecution in Dallas by his former befriended fellow-convict whom he had taught to read in San Quentin and who finally blackmailed him out of town, bringing on the seizure or breakdown in St. Louis, which landed him in Ward's Island, N. Y. In all this he recalled or at least mentioned nothing which was detrimental to himself, nor did I make any inquiries on these points.

His confidence thus having been apparently gained, he was quite willing to try hypnotic suggestion in our afternoon interview. But with his nervousness, as shown in his slightly stammering, unsteady rolling eye movements, and mouth-twitching, it was with great difficulty that his attention was held. But after about an hour's work with his eyes following my slow finger movements and with constant verbal suggestion he seemed to stand the negative suggestion test on eyes, arms and legs, but in his over-gentlemanly desire to please I was not at all sure that he was in genuine hypnotic sleep. However I

now strongly suggested that he could remember all his trip, and began going over it backwards in detail. His replies came slowly and naturally. Thinks he must have come to Mankato from St. Peter, can't tell where he left or lost his satchel, doesn't think he had it in St. Paul, and so must have left it in Winnipeg. Can't tell where he stopped in St. Paul, but roomed at some lodging house and ate at some restaurant. Thinks the church where he heard the sermon was stone, can't tell how far from his lodging house, "only a short walk." Thus we went over this ground again, trying for two hours to locate some memory like his satchel, or lodging in St. Paul which could be verified.

In the evening we continued an hour more. He recalled the hill or sharp decline down to the river by the station in St. Paul (correct). Thinks his lodging house was in a terrace or row, and about straight up from the station, and could find it again if there. But although we went step by step in memory together up the street he could not locate it. Could only describe his hotel in Winnipeg as being in about the middle of five or six hotels on a public square, with public buldings on one or more sides. On his second visit there he stopped at private lodgings. He woke up from his hypnotic sleep unnaturally as before and seemed surprised at the length of time he had been sleeping. During this second hypnotic sleep, after twenty minutes of suggestion without eye movements, he did not stand the cataleptic test well, nor the pain test until after several trials. Given a post hypnotic suggestion to ask me, about five minutes after waking, to wrap up my photographs, he at about the right time asked me in a conscious way what he was to tell me about photographs.

Altogether I had little confidence in the genuineness of his hypnotic condition and as he recalled only a few unimportant additional details it did not seem worth following this trail further. Also the next morning he complained of bad sleep and of bad headache from the strain on his eyes and attention, and preferred not to be hypnotized again. So we had a finale normal interview for over three hours, in which he voluntarily went over the Fruitdale and Blanchard business, demonstrating most plausibly with diagrams and figures how their business pinch came by his leasing a third timber tract and sinking $2000 therein, how ridiculous Blanchard's accusations were,

for how could he carry on a big cash lumber business without paying out money, and asserting with filled eyes and quivering voice that this worry and strain, together with his book-keeping from four to six A. M. and his running back and forth all day between the three plants, broke him down and he suddenly lost all memory of himself on June 17th, 1896.

His other misfortunes too he went over, until, when arranged in chronological order, they gave the following outline of his life:

1. Loss of his wife's money in the furniture business in Leeds, Eng.

2. A lumber and fuel venture in North Carolina, on the edge of the Dismal Swamp, and which came to an end through a mortgage foreclosure.

3. A second lumber and fuel stock in North Carolina burned, and was lost through a bogus insurance company, in which it was insured. Here his wife died. "A most estimable woman, the light of my life went out then."

4. California lumber lease with attendant false imprisonment in San Quentin by parties plotting for his lease.

5. The Seattle box business and disclosure.

6. His rising to the control of a box factory in Dallas, Texas, and blackmailed by a former fellow convict and pupil.

7. Loss of identity for a few days in St. Louis, and his three months' residence in Ward's Island Hospital.

8. Fruitdale-Blanchard lumber scheme.

9. Four months' loss of identity.

In all this talk he varied from the extremes of a professional promoter of schemes with the greatest persuasion and plausibility to that of a hopeless striver against fate. Several times his eyes filled and once the tears flowed freely. He evidently took great pride in these large business enterprises which he had carried on with undoubted energy against difficulties, and explained his series of failures as due to some form of persecution.

Thus in these interviews in the normal and in the pretended or genuine hypnotic condition he had recalled scarcely anything more than he had told others up to this time. Of the dishonesty charged against him he either still remembered nothing, as in the Blanchard matter, or he had explained them plausibly away. Nor could we get on the track of any new memories which would be of any evidential value on the question of his

honesty. Whether then under these suspicious circumstances his alleged loss of identity was genuine was an interesting and difficult psychological problem. Prof. Koehler, who studied him considerably, saw not a single thing in which he could detect duplicity, and thought Hall made a sincere and child-like struggle to find himself. Dr. Andrews, under whose care he was during his entire six weeks in Mankato, did not think him an intentional and scheming fraud, but sincere. He asked no one for money, and worked faithfully at painting and odd jobs about Dr. Andrews' house to show his gratitude, and was thankful for the good and kind care of other Mankato people. But the popular judgment, as well as Mr. Blanchard's, was that his loss of memory was feigned to cover his dishonesty. Subsequent events have at least increased the evidence for the dishonesty element in his mental composition.

His friends in Mankato, not finding employment for him, sent him to Minneapolis on Dec. 24th, 1896. He sought out Rev. William Wilkinson, Rector of St. Andrews Church, who found him a perfect gentleman, willing to do anything, and never begging. While making many efforts in vain to find employment for Hall Mr. Wilkinson kept him some weeks at his house and made a place for him as janitor of his church. Here he made a splendid reader in the church as well as a faithful painter of its outside. In a call on me in Feb. '97, Hall made no mention of his janitorship, but described himself as Rev. Mr. Wilkinson's assistant in his parish, having made over two hundred calls on families in that vicinity, but found only three churchmen, which he considered uphill work. He was also getting up a lecture for churches and Sunday schools on "Christ in Art and Song, illustrated by stereoptican reproductions of the most famous works of ancient and modern art." Thus he hoped to make himself no burden on his church, where he could not expect anything in a money way, but where it was agreeable to him. He gave his lecture here and in several towns of the state. He thought this plan of living down the past and showing people what he could really be was the best. As for going back to Alabama he had no desire, and especially so without capital—"Better let the past bury the past." Reverting to his Mankato friends he thought Rev. Mr. Davis had done a very unchristian thing to publish in "The Living Church," a letter against him from a clergyman in Seattle. Concerning this Mr. Davis writes (Oct. '98): "Hall was

wrong in stating that I published the Rev. Mr. Foote's letter. Having published my first letter asking for information which might lead to the discovery of Hall's identity, and that letter having aroused a widespread interest and sympathy from all parts of the country, and some even from Canada and England, I felt it a duty to the public, when Hall's rascality had come to light, to publicly state that his name had been discovcovered and that his record did not show that he was worthy of the respect and confidence of the community."

This gentleman had twice sent letters of invitation to Hall when in prison in California to visit him after his sentence expired, but afterward had occasion to change his opinion of Hall and so wrote Mr. Davis. Even the narrow life of a country parish he thought could hardly excuse this petty and mean act. Thus he appeared now to have no gratitude to Mr. Davis, nor to his other Mankato befrienders who had not renounced him.

For about a year Hall was engaged here in these varied church activities, though meanwhile making real efforts to find some business employment and enduring much distress of mind and body. One day in the fall of '97 he told his landlady he was going to St. Paul for a couple of days; but he never came back. He wrote her several letters from various towns on the way to Chicago, where he was giving his lecture or canvassing. The last word from him came during the winter of '97-8 from the address of an Episcopal Clergyman in Cincinnati. His landlady reports him as a perfect gentleman, having done splendid work in building up the church, having won the complete confidence of her husband and herself, so that she scarcely regrets his never having paid for his several months' lodging. However, his stereopticon supply man does not feel so charitably about his unpaid bills, while Mr. Wilkinson is indignant at the indorsed note for the stereopticon which he has had to pay. For this and other reasons too, he thinks Hall a rascal.

When one now looks back at this strange mental composition to analyse and classify it there appears to me two important characteristics connecting him over toward the insane.

1. A delusion of grandeur ("Grœssewahn") as shown in his restless activity and pleasure in these series of large schemes started on such small foundations. His absorption in them was intense, leaving him no interest for other things except his church. In my interviews with him he could not get away

from talk about himself; some brain micro-photographs, which I, for this purpose, showed and explained to him, had no interest. In his church even he pushed himself forward everywhere in an unusually commanding way.

2. The common delusion of persecution was an easier explanation of his series of failures than the reasonable and evident lack of foresight, capital, and honesty. But no such reasoning would affect him. The reversed judgment of his friends, who came to know him thoroughly, was explained too in this way.

With these two characteristics, which are only exaggerations of the normal mental components of pleasure in activity and success and of suspicion, is specially connected the question of his consciousness of and responsibility for his dishonest practices, however great or small they really have been. That he is not a deliberate or conscious knave or even deceiver seems to me reasonably sure. And as therefore the ordinary motives which influence the average mental complex do not come into his consciousness with inhibitory or motor force, he is not responsible as is the average man. His case is of much interest as an example of the many components of knowledge, feeling, and motor reaction, which constitute the manifold complex "mind," and the limitless variety of these combinations, with the wide transition region between sanity and insanity. In its non-responsibility the case illustrates the modern "necessity" of willing as a reign of law in mental life as against the old metaphysical "freedom." His would be a case for restraint and not punishment.

As to the genuineness of his loss of personal identity, it seems to me in some degree at least genuine, and perhaps entirely so. His unstable nervous temperament, with its excessive activity and disposition to worry and suspicion, was favorable to such a catastrophy. For the first collapse in August, '95, though only of short duration, there seems no motive for deception except to gain a retreat and rest. And if the first one was genuine the still greater stress of circumstances, which culminated in June, '96, was enough to cause a greater mental rupture. However, the suspicious limits of his recovered memories remind one of the often wonderfully ingenious reasoning and cunning self-control of the insane, and give much evidence to the probability that with some real loss of memories he con-

sciously or unconsciously—as it seems to me more likely—used his more or less mental break to cover his dishonesties.

I am fortunate to be able to append the following examination of Hall by Dr. H. A. Tomlinson, Superintendent of the St. Peter State Hospital for the Insane, and gratified at the approach of my conclusion to his judgment, founded on such greater knowledge and experience.

March 23rd, 1898.

"The man was undoubtedly an epileptic, the muscular outbreak being absent and replaced by the establishment of so-called double consciousness. This was evidenced by his conduct and history, both as given by himself and learned from others afterwards. I did not know anything about Mr. Hall's ever having been in a hospital for the insane, but should not be surprised to learn that he had been in several, for that is the usual history of such cases. I did not make any notes of my examination of this man and my recollection is hazy as to details. I remember, however, having noted several of the stigmata of degeneracy and among them some asymmetry in arterial distribution and location. Besides, the radial artery on one side was quite small, while on the other it was disproportionately large. Several similar cases to this one have been reported and one I knew myself much more peculiar than this one. There is no doubt but that this man was markly defective morally and traded on his peculiar mental condition, of which he was more conscious than he was willing to admit or recognize. These cases seem very clear to me, presenting only exaggerations of those characteristics which make the confidence man and dead-beat conspicuous. The difference being that one acts with definite purpose and from preconceived plans, while the other is the creature of environment, apparently acting automatically upon the suggestions of those around them."

In the prosecution and preparation of this study I wish to express my sincere thanks for the kindness and aid of Rev. George H. Davis, Dr. J. W. Andrews, Prof. C. F. Koehler, Mr. E. F. Searing of the Mankato Free Press, and Dr. H. A. Tomlinson.

HARLOW GALE.

In connection with this case the most interesting genuine one I know of is that of Rev. Ansel Bourne, of which the full report is by Richard Hodgson, "A Case of Double Consciousness," in Proceedings of the Society for Psychical Research, vol. VII, pp. 221-6257, and an abridged account in James' Psychology, vol. I, pp. 391. See also other cases in James' chapter on "The Consciousness of Self." Other cases and important works bearing on this case are:

Binet—Alterations of Personality, 1896.

Azam—Hypnotisme, double conscience et alterations de la personnalite, 1887, (having the original of the famous case of Felida X.)

Janet, Pierre—L'Automatisme psychologique, 1889.
Ribot—Les malades de la memoire, septieme ed. 1891.
" " " " " personnalite, troisieme, ed. 1889.
(Both the above translated by the Open Court Pub. Co., Chicago, 1894).
Carpenter—Mental Physiology, chap. 10, "Of Memory." 6th ed. 1891.
Maudsley—Responsibility in Mental Disease. 4th ed. 1895.
Maudsley—Pathology of Mind. 3rd ed. 1879.
Lewis—Text Book of Mental Diseases. 1889.
Krafft-Ebing—Lehrbuch der Psychiatrie. 4te Auf. 1890.
Ziehen—Psychiatrie. 1894.
Flechsig—Die Grenzen geistiger Gesundheit und Krankheit. 1896.
Dana—The Study of a Case of Amnesia or 'Double Consciousness.' Psychological Review, vol. I, 1894, pp. 570-580.

PSYCHICAL RESEARCH IN AMERICAN UNIVERSITIES.*

As a part of my own interest in psychical research, it seemed to me it would be interesting and profitable to try to gather together some report on the place of psychical research in our university teaching. For in any new line of investigation there comes a time when, with the development of methods and the accumulation of a sufficiently trustworthy mass of material, some claim can be made to the presentation of its methods and results in educational institutions. Psychical research seems naturally to fall under Psychology, and so it is for instructors in psychology to decide when these newer subjects of psychical investigation deserve a place in our university courses.

At Harvard, Professor James gives about fifteen out of forty-five lectures in his course in Abnormal Psychology to psychical research work. But neither of his psychological colleagues, Royce or Münsterberg, takes at present any active interest in the subject. In Columbia the only allusion to the subject is by Prof. Hyslop, who regrets that lack of time and a proper psychological course only allow him to mention it. He hopes, however, to offer some special work in this subject, and if time and opportunity presented itself, would give a course for the whole year. He is "convinced that the experimentalist who ignores and taboos it, or refuses to understand it (it is not necessary to believe in it) is going to be left behind, and will lose his influence; for the time is coming in the near future when he will be called upon to discuss a problem which he has not equipped himself to discuss." However, neither of those in charge of the experimental or abnormal Psychology "pays the slightest attention to psychical research *a la* the English Society." The experimentalist "taboos it throughout, but has never even read the reports and their experiments in telepathy."

*Reprinted with additions from the Proceedings of the Society for Psychical Research. Part 33. Feb. 1898. Vol. XIII, pp. 583-588.

At Pennsylvania, Professor Newbold says, "My own interest in the matter is very keen, and I regret very much that my work leaves me no time for original research. I do not, however, introduce it into my teaching. In the first place I am giving no course in which the subject would naturally find its place, and in the second place, I am by no means sure that it is desirable, either for the sake of the cause or for the sake of the students, to do so. I always, however, so far as possible, endeavour to arouse the interest of any individual student who seems possessed of the good sense and judgment which are so essential in one who intends to deal with such questions." Perhaps quite naturally Professor Fullerton's six years of work with the Seybert Commission, in which he came in contact with fraudulent mediums only, has resulted in giving him a thorough distaste for the whole subject. The experimental Psychologist there is an orthodox of the pronounced type, and glories in the fact that he is not in the least interested in "so-called psychical reseach." Since the same man has charge of the work in experimental Psychology at Bryn Mawr (Women's), this complacent superiority prevails there also; although Professor D. S. Miller, Associate Professor of Philosophy, gives four or five lectures of his introductory course to Hypnotism and psychical research, and formerly, in an advanced course, gave them more time.

At Brown, Professor Delabarre has a "Seminary on 'Abnormal and unusual States of Consciousness' during the winter term, in which the work of the S. P. R. is referred to and criticised."

At Smith (Women's), Professor Gardner reports:—"My reference to that work in my classes is only incidental. Some years ago I had an elective course in which hypnotism, clairvoyance, telepathy, etc., were considered in some detail, but I gave it up, as it seemed to me that the work was not of that disciplinary character which I consider the main work of a college should be."

The subject gets some attention at Chicago, in connection with the regular psychological work, but it is given no independent treatment.

A psychologist of one of our larger Universities gives some criticism to psychical research, but does not wish his name mentioned in this connection.

From Cornell an Associate of the Society reports that not only is there no psychical research work there, but that the Psychologist "will not even have the S. P. R. *Proceedings* in the library lest they should inflame the imaginations and corrupt the minds of the students. This policy recently led to the somewhat comical result that he had to borrow books of me, when he needed them for polemical purposes."

The attitude at Yale, aside from indifference, is shown in the warning "against the unjustifiable application of the term 'experiment' to hypnotic exhibitions, to thought-transference follies, and to the so-called psychical research experiments. These amusements are as unrelated to scientific experiments as clairvoyant healing and faith-cure to the science of medicine," (Scripture: *Thinking, Feeling, Doing*, 1895, p. 26). In his *New Psychology*, 1897, the same "New Psychologist" selects some S. P. R. cases as a travesty contrast to the experimenting of the trained scientist, and again sums up the detailed study thus: "The objections to psychical research lie in its unscientific methods of experimentation and in the air of occultism in which the whole is enveloped. If the investigators were trained in the psychological laboratory, we might expect interesting discoveries in regard to mind, while at the same time the repellent mysticism would disappear along with odic force, animal magnetism, thought-transference, and other ghosts" (pp. 62-69).

At our distinctively psychological University, *i. e.*, Clark, the position of President Stanley Hall was shown in his review of the *Proceedings* and *Phantasms of the Living* in the first number of his *Journal of Psychology*. He then wrote in 1887 from Johns Hopkins that the formation and plan of the S. P. R. were "such as to commend it, not only to every psychologist, but to every true and intelligent friend of culture and religion"; and, in most gratifying contrast to many cases of dogmatic incredulity, he has followed the publications of the S. P. R. in two reviews (*Journal of Psychology*, Vol. I, pp. 128-146; Vol. VII, pp. 135-142.) He has made experiments in normal and hypnotic reaction times (*Mind*, Vol. VIII, p. 170) in his laboratory at Johns Hopkins. There also, Drs. Jastrow and Nuttall made their investigation "on the existence of a magnetic sense" (*Proceedings of the American S. P. R.*, p. 116.) He himself had also up to 1887 "spent much time and labour in repeating

with many subjects nearly all the experiments of the English Society."

Under these conditions of experience, and along with much suggestive criticism, it is to be regretted that he then concludes "that the crude and premature theory of telepathy . . . . lacks everything approaching proof save to amateurs and speculative psychologists" (*Journal of Psychology*, Vol. I., pp. 143 and 146). Instead of bettering its claim during the next eight years his judgment seems more severe. For he is profoundly convinced that "the telepathic presumption is yet very far from being a *prima facie* case, is premature at best, and that it is at present with its rank mazes of mystic guess-work a source of befuddlement and obfuscation galore. To say that telepathy 'is a name given in lieu of a theory about it,' or, with Mr. Podmore, to say it 'involves just as little theory as Newton's conception of gravity,' seems to us almost grossly misleading, to say the least. Telepathy began as a definition of a new mode of psychic interconnection, and, instead of resting on the commonest facts of sense, and proving by mathematics, it has yet to find a single fact that can be demonstrated regularly in laboratory courses that proves or even illustrates it with certainty. . . . The writer has diligently read the experiments of the proceedings, and can honestly say that there is not one in which the conditions as reported seem to him satisfactory. . . Give us one little fact, ever so little, that we can freely test and reproduce in our laboratory. We will cross seas to see it, will acknowledge our mistaken scepticism, and confess telepathy, and turn the research of one laboratory at least in a new direction" (*Journal of Psychology*, Vol. VII., pp. 137 and 139).

On the other hand, however, Professor James gives most weighty influence to psychical research through such reviews as those in the *Psychological Review*, Vol. II, p. 67, and his reply to Prof. Cattell, of Columbia, in Vol. III, p. 648; not to speak of his presidential address and papers within the S. P. R. itself.

Here in the University of Minnesota I have given in the spring term of my junior year course in Psychology, nine weeks or thirty-six hours to psychical research, including two weeks on Hypnotism. In the first twelve hours the evidence on Telepathy is outlined after the plan in the *Phantasms of the Living*. Mr. Podmore's *Apparitions and Thought-transference*

makes an invaluable book for the students in this problem and the cases brought into the lecture room are largely supplementary to those in these books. Practical demonstrations of the methods in the experimental cases, and a constant analysis and criticism of these and of the spontaneous cases, stimulate some students to experiment with valuable results.

In the next sixteen hours the other more negative parts of the Society's work are outlined. In addition to the most useful summaries on some of the subjects given in Mr. Podmore's *Studies in Psychical Research*, Mr. Myers' "Resolute Credulity," and in Professor James' essay in his *Will to Believe*, perhaps the appended note of references may be stimulating to a further presentation of them. Upon our reference table, as well as in the University and Public Libraries, are sets of the S. P. R. publications, together with some of the standard works on the subjects. To these I add something from notes of my own experience with professional mediums, and show a collection of alleged spirit photographs compared with ones of my own manufacture.

Then follow the eight hours of demonstration in non-sensational psychological phenomena of Hypnotism, and the following of suggestion through its various names and phases of Suggestive Therapeutics, "School of Psychology" (Chicago), Mind and Faith Cures, Metaphysical, Magnetic and Divine Healing, Christian Science, etc., etc.

Coming, as this term's work does, after one term of lectures and demonstrations in the Physiology and Psychology of Sense Perception, and a second term on Association, Memory, Feeling, and Willing, it gives a most valuable review of many of these phenomena, and their meaning is greatly enlarged by the new light from these points of view. So that this term is not only naturally more popular than the other two but, so far as I can judge from three years' trial, it is the most profitable of all to the students. For few undergraduates get any serious meaning of the relation of the modern knowledge of our wonderful nervous mechanism to our conscious life, of the complex processes of sense perception to our real criterion of truth and limits of knowledge, of the pleasure-pain elements as the highest developments of our evolution and the ultimate basis of all conduct. But most students are still surrounded by a bewildering maze of alleged supernatural

psychical phenomena, which the ordinary psychological instruction does not attempt to pierce. If, however, the student can gain some analytic power in the classification of these mixed phenomena, some critical sense of what proof has been offered and should be offered in each category, the relations of the residuum thus gained to our already established and explained psychical facts, such an acquirement will, I think, do vastly more than the usual harmless psychological "discipline" towards making strong men. This so neglected function of criticism in education accounts for the often exasperating slowness with which phenomena are transferred from some modern form of Animism to natural Science. Though I appreciate in the highest degree, and after four years' experience of the Psychological Laboratories of Leipzig and Berlin, the great work which experimental Psychology is consciously or unconsciously doing in freeing Psychology from Metaphysics and raising it to a worthy place among the Sciences, yet I deliberately believe that for immediate practical returns in education, the S. P. R. has more to offer than all the Psychological Laboratories. If others do not go so far, may we at least beg that one of the two groups of psychological workers so excellently described by Mr. Myers ("Resolute Credulity" *Proceedings*, XI., p. 233) may try to enlarge its horizon to get a fair view of the other.

Since the above was written from material collected in the spring of 1897, there has been much progress in the attention given by the Psychologists and, thro University influences, by the public to the Society's work. An important article has appeared on "Some Peculiarities of the Secondary Personality," by Prof. G. T. W. Patrick in the Psychological Review for Nov., 1898, Vol. V, pp. 555-578,—important in that it is the first article on this subject to appear in this Review, and to appear in a number of "Psychological Studies," in whose own studies thus the author has reprinted this article.* It is also important for the following courageous stand by one not identified with the S. P. R. "It has been felt that to maintain the dignity of experimental psychology, this subject and certain related ones must be ignored. They have been almost uni-

*See the Studies in Psychology by G. T. W. Patrick, which is a Bulletin of the University of Iowa. New Series, Vol. I, No. 5. Cf. the review of this article by Mr. Myers in Proceedings. S. P. R. Vol. XV, pp. 382-386. The first article on Psychical research in this Review was by Prof. Hyslop, "Psychical Research and Coincidences," in Vol. V, pp. 362-387.

formly kept out of American psychological laboratories, where infinite labor has been spent on other probably less fruitful problems. But experimental psychology has now long passed its probationary period and may quite freely choose its subjects for research, and at present there is perhaps no other subject promising to throw more light upon certain dark chapters in mental science than that of automatism. — — — Without denying its great debt to psychical research, experimental psychology may profitably take up the problem of automatism, applying still more rigorous methods, and, what is of greater importance, include in its investigations a larger number of more simpler cases," (pp. 556, 557). As to instruction in our universities on these subjects can be added the following from Prof. Patrick: "I wish that more could be done because I am sure the field is a rich one. But the study of this subject is more difficult in America because of popular prejudice. We have here a one-term course in Abnormal Psychology. It is under the direction of Dr. Seashore. He takes up sleep, dreams, hypnotism, automatism, and psychical research, devoting to the latter subjects of course, more time than to sleep and dreams. This is all we do except so far as we carry on researches such as the one I reported in the Psychological Review. The field is a very attractive one to me, altho I consider this work, as far as research in concerned, as a kind of indulgence, which I must not allow to interfere with systematic psychology."

A splendid article has appeared in the *Journal of Psychology*, Vol. X, pp. 431-502, on "The Effects of Mind on Body as Evidenced by Faith Cures," by H. H. Goddard. Tho it has not noticed similar articles under Psychical Research, it is of the high standard of work and ability set by the *Journal*.

Three spirited combats—unfortunately too spirited—have occurred by the references of professional psychologists to the work of the S. P. R., and by professorial defenders of its work. The first is a caustic review of Scripture's "New Psychology," in its reference to psychical research, by Prof. Hyslop in the Proceedings S. P. R., Dec. 1898, Vol. 14, pp. 144-146. The reviewer points out in detail that the author "betrays absolute ignorance of the subject which he attacks and ridicules. And this after such repeated demands for thoroughness."*

*It had already appeared evident to me too that Scripture's knowledge of the S. P. R. telepathy experiments in drawing were second-hand thro the Lehmann-Hansen article.

The second combat arose from Prof. Münsterberg's article on "Psychology and Mysticism," in the Atlantic Monthly for Jan. 1899 and reprinted in his volume of essays entitled "Psychology and Life," pp. 229-282, which article had done previous missionary service as a lecture at a Unitarian Minister's Institute, and for the Philosophical Department of Princeton University. Such a rhetorical travesty was met with the keenest counter ridicule by Mr. F. C. S. Schiller, then of Cornell and now of Oxford, in "Psychology and Psychical Research: "A Reply to Prof. Münsterberg," in the Proceedings for July, 1899, Vol. 14, pp. 348-365. *Because Prof. M. protested at an unfair stroke of his assailant, Mr. S. added a couple of pages in further justification of this mode of education in Vol. 15, p. 96.

The third encounter arose from the close of a harmless and interesting little article by Prof. Titchener on "The Feeling of being Stared at," in *Science* for Dec. 23, 1898, which ended thus: "If the scientific reader objects that this result [the dissipation of this popular belief by an analysis into several psychological components] might have been foreseen, and that the experiments were therefore, a waste of time, I can only reply that they seem to me to have their justification in the breaking down of a superstition which has deep and widespread roots in the popular consciousness. No scientifically-minded psychologist believes in telepathy. At the same time, the disproof of it in a given case may start a student upon the straight scientific path, and the time spent may thus be repaid to science a hundredfold. The brilliant work of Lehmann and Hansen upon the telepathic 'problem' (Philos. Studien, 1895, XI, 471) has probably done more for scientific psychology than could have been accomplished by any aloofness, however authoritative." Whereat our veteran champion, Professor James, appeared this time to protest that the Lehmann-Hansen experiments were by no means a disproof of telepathy. And even tho he later published a letter in which Lehmann himself confessed that his theory against telepathy was not proved, yet there were six exchanges of shots in *Science* during

*The opening shot is as follows: "*Boss locutus est*: Professor Hugo Munsterberg, of Harvard University, the lord of I don't know how many thousand dollars worth of psychological machinery, has planted the banner of the only genuine psychology amid the pulverized fragments of Mysticism, and sent back the Cinderella of the sciences, Psychical Research, to supervise what alone she is fit for, viz., the culinary operations of the witch's caldron."

the next half year. These have all been collected in the Journal of the S. P. R., Oct., 1899, Vol. IX, pp. 113-120, with some clarifying and harmonizing comments by the editor of the Journal.

But the most important and serious event has been the publication of an abstract of his sittings with Mrs. Piper by Prof. Hyslop, under the title of "Immortality and Psychical Research" in the *New World*, for June, 1899. This and some shorter articles and explanations in other periodicals have attracted very great popular attention, and his name and university position have gained a wider and more serious consideration for Mrs. Piper's phenomena than any other means yet used.

In connection with the question of the identification of persons by more unimportant characteristics, he has made some experiments at Columbia on the means by which persons at either end of a telegraphic communication identify each other. See Journal S. P. R., Jan., 1900, Vol. IX, pp. 162-169.

The full report of these experiments and of his sittings with Mrs. Piper are thus awaited with an interest all thro the country never before reached by the S. P. R. And one most vital point is gaining great ground with persons of serious culture, as also I find more and more with my best students, viz., whatever one's judgment on the evidence of Mrs. Piper's phenomena for the continued existence of disembodied personalities, people are brought to realize that the old problem of immortality should be one of psychological evidence and not of theological dogma, nor religious blind faith, nor metaphysical poetical analogies. And in fact many realize that the only data that will stand the test of evidence are just these phenomena, however trivial or even repulsive they may seem, with which our society deals. To those of us who still think that the data by no means proves or even gives much probability to immortality, there is gained an intellectual strength by having studied the available evidence. And the explanation of this psychical research data by analysis into its psychological elements is of itself a most satisfying intellectual pursuit and a means of understanding with great charity how so many people believe so much on so little evidence.

Harlow Gale.

References to Psychical Research Phenomena, aside from Telepathy.

[Roman numerals refer to *Proceedings* S. P. R., unless otherwise indicated.]

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Mrs. Sidgwick's Report. IV., 45. See also article in *Encyclopedia Britannica.*
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" " Professor Barrett. XIII., pp. 2-282.

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" and Myers. Some higher aspects of Mesmerism. III., 401.

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CATALOG

of reproduced schematic cuts and plates and of original micro-photographs of nerve cells and tracts; prepared as lantern slides for lecture use in the Histology, Physiology and Psychology of the human nervous system.

The following list of lantern slides were made for use in my own lectures, where the ground sketched in the article in these Studies on Our Nervous System and its Use is gone over with more detail and illustration through four or more lectures. The object is to gather together the latest and most reliable pictures of the brain elements, their connections, and their probable functions. Tho these are specially prepared for giving psychological students some needful knowledge of the results of the modern Histology, Embryology, and Physiology of the brain as the real basis of our mental life, yet they may be of service also in these special sciences.

The negatives of the copied cuts and plates I took thro a reducing camera with a Bausch & Lomb Zeiss Anastigmat lens, and the lantern slides are printed by contact. The negatives of the micro-photographs I took through a Leitz microscope and lenses, with eye-piece, with a simple camera attachment of my own, and on 4x5 plates, with a magnification usually of 100 diameters. The plate best adapted to the green and yellow background of the sublimate and silver preparations was found after much trial to be a slow isocromatic (Cramer's), and the best developer for getting a good contrast of the black cells and fibers against this background (to come out white) was Hydrochinon with bromide (Cramer's Contrast formula). From these 4x5 negatives the lantern slide positives were taken with the above reducing camera and lens.

To any persons interested in this kind of micro-photography with comparatively low powers, I shall be very glad to

The references to the figures in the parenthesis are to the figures in the articles on our Nervous System and Its Use, where these photographs were used.

show my apparatus or communicate any of my experience from the two years' work in making this collection.

The preparations are also original, most of them I made in the Anatomical Institute of Professor His in Leipzig, under the direction of Dr. Held, during 1893-4. This collection of preparations, which are studied in the original by a few of my advanced or special students, are as follows:

About 200 slides of cord and brain cells, mostly human, stained by the slow Golgi sublimate method, and the quicksilver method, with some carmine and hematoxylin ones.

For comparative study of the tracts on the Flechsig development method, eight series of human bulbs stained with Weigert-Pal hematoxylin method, as follows:

1. Adult, cross sections, every third section thro the medulla, and occasional sections far into the basal ganglia.
2. New-born child, cross-sections from pyramid crossing to the corpora quad.
3. Seven day child, length-sections, and cut at right angles to the fissurae.
4. Foetus, 37 cent. (about 7 mos.), length sections, and cut parallel to fissurae.
5. Foetus, 42 cent. (about 8 mos.), cross-sections.
6. Foetus, 37 cent. (about 7 mos.), cross-sections.
7. Foetus, 31 cent. (about 6 mos.), cross-sections.
8. Foetus, 27 cent. (about 5 mos.), cross-sections.

Series 2 to 8 include every other consecutive section. The entire human series comprising 250 slides of the 7x10 cent. size.

Also animal series thro a pigeon's brain, bulbs of fish and calf.

REPRODUCED SCHEMATIC CUTS AND PLATES.

Retzius: Biologische Untersuchungen, Neue Folge 1892, Bd. IV, Tafel XV, Fig. 4 (Fig. 2).

1. Haare mit ihren Scheiden und den in ihnen endigenden Nervenfasern aus der Wangenhaut, der Schnauze (und des äusseren Ohres) von 5-6 tägigen Mäusen. Verticalschnitt der Haut.
2. Zahn eines Gobius in Längenansicht: Nervenfasern, welche dicht an der Innenfläche des Zahnbeins emporsteigen und frei endigen. Tafel XVII, Fig. 7, (Fig. 4).

Das Sensible und Sensorische Nervensystem. Seite 56.

3. A. (Fig. 7.)
4. B. (Fig. 11).

Van Gehuchten: Le systeme nerveux de l'homme, 1893.

5. A. Schèma des voies longues à travers tout l'axe cèrèbro-spinal.
   B. " " " courtes ou fibres commissurales longitudinales de la moelle épinière. Fig. 417. A. (Fig. 1).
6. Schèma montrant l'origine et la trajet probables des fibres de la voie motrice central dont l'existence semble devoir être admise dans l'etat actuel de nos connaissances. Fig. 510.
7. Ditto avec voie sensitive central. Fig. 511.
8. Schèma montrant l'origine et la trajêt des fibres constitutives de la voie acoustique central (construit d'après la description de H. Held). Fig. 482.

R. y Cajal. Neue Darstellung vom histologischen Bau des Centralnervensystem. His' Archiv für Anatomie (und Physiol.) 1893. pp. 319-428.

9. Schema des Verlaufes der Nervenreize von den Stäbchen und Zapfen bis zu den Corpora Geniculata. Fig. 28.
10. Schema des Verlaufes der Nervenreize im Olfactorus apparat der Säugethiere. Fig 24.
11. Die obere Reihe von Zellen repraesentirt die psychischen Zellen bei den verschiedenen Vertebraten. A: Rana. B: Eidechse. C: Maus. D: Mensch. Die untere Reihe zeigt die Entwicklungsphasen der psychischen oder Pyramidenzellen.
    a: Neuroblast ohne Protoplasmastamm.
    b: Beginn eines solchen Stammes und einer fasernartigen Verzweigung.
    d: Auftreten von Collateralen am Achsencylinder.
    e: Bildung von Protoplasmafortsätzen am Körper und Stamm. Fig. 13. (Fig. 34.)
12. Halbschematischer Querschnitt durch die Kleinhirnwindung eines Säugethieres. Fig 8. (Fig. 16).
    Comparative Study of the Sensory Areas of the Human Cortex. Decennial Celebration of Clark University. 1899.
13. Cells of the visual cortex, infant 15 days old, 4th layer. Fig. 11. (Fig. 31).
14. Nerve plexus of the 4th and 5th layers from the visual cortex of an infant aged 20 days. Fig. 18. (Fig. 23).
15. Photograph from photogravure. (p. 27).
    Golgi: Sulla fina anatomia degli organi centrali del sistema nervoso. 1885.*
16. Frammento di sezione verticale di una circonvoluzione cerebellere dell-uomo. Tav. VII.
17. Sezione verticale della corteccia della circonvoluzione centrali anteriore (uomo) Tav. IV.
18. Sezione verticale della corteccia della circonvoluzione occipitale superiore (uomo) Tav. III.
    Dejerine: Anatomie des centres nerveux. 1895. Schema de quelques neurones moteurs et sensitifs de l'homme. Fig. 113. (Fig. 12).
19. Face interne de l'hemisphère gauche. Cingulum faisceau basal interne et faisceau longitudinal inferior vus par transparence. Fig. 374.

*The above plates are produced better than in the original in the Jena, 1894, German collection of Golgi's studies, translated by Dr. R. Teuscher. "Unterschungen uber den feinerer Bau des centralen und peripherischen Nervensystems," where the above are Tafeln 11, 7 and 8.

20. Face externe de l'hémisphere gauche les bords de la scissure de Sylvius ont été écartés pour montrer l'insula et la région rétro-insulaire. Les faisceaux uncinalus, arqué ou longitudinal supérieur et occipital vertical sont vus par transparence. Fig. 377. (Fig. 41).
    Kölliker: Handbuch der Gewebelehre des Menschen. 2ter Band. Nervensystem des Menschen und der Thiere, 1896.
21. Schema, die wichtigsten Zellen und Faserverhältnisse der Hirnrinde bei der Maus und beim Kaninchen darstellend. Fig. 745 (colored) (Fig. 22).
    Starr: Atlas of Nerve Cells, 1896.
22. Diagram of the cells of the cerebral cortex. The cells are reproduced from the plates. Fig. 10 (Fig. 32).
    Meynert: Psychiatrie, Erste Hälfte, 1884.
23. Schema für die Entstehung einer bewussten Armbewegung. Fig. 60 (colored).
24. Schema für die Entstehung des bewussten Lidschlages. Fig. 59 (colored).
    Hammerberg: Studien über Klinik und Pathologie der Idiotie, nebst Untersuchungen über die normale Anatomie der Hirnrinde, 1895.*
25. Querschnitte durch normale Hirnrinde von einem 28 Jahre alten Manne. Tafel I.
26. Ditto. Tafel II. (Fig. 35.)
27. Ditto. Tafel III.
28. Querschnitte durch d. Hirnrinde von Schwachsinn-und Blödsinniger. Taf. IV (Fig. 36).
29. Ditto. Taf. V.
    Flechsig: Gehirn und Seele, 1896.
30. Sagittalschnitt (der Mittlebene des Körpers parallel) durch das Gehirn eines einmonatlichen, vermutlich reif geborenen Kindes. Taf. I, Fig. 1. (Fig. 38.)
31. Horizontalschnitt durch das Gehirn eines dreimonatlichen Kindes. Taf. I, Fig. 2.
32. Schnitt aus demselben Gehirn wie Fig. 1. Taf. II, Fig. 3.
33. Horizontalschnitt aus dem Gehirn eines Anfang der 2 Lebenswoche gestorbenen Kindes. Taf. II, Fig. 4. (Fig. 37.)
34. Sagittalschnitt durch des Gehirn eines Endedes. 2 Lebensmonats verstorbenen Kindes. Tafel III. Fig. 5.
35. Sagittalschnitt durch das Gehirn eines angeblich im 5. Monat verstorbenen, vielleicht einge Monat älteren Kindes. Tafel III. Fig. 6.
36. Die Sinnescentren sind — — — punktirt, die Associationscentren einfach grau getont. Rechte Grosshirnhemisphäre von aussen. Tafel IV. Fig. 7. (Fig. 39).
37. Ditto. Innerfläche der linken Grosshirnhemisphäre. Tafel IV. Fig. 8 (Fig. 40.)
38. — — — Karte der Leitungsbahnen des Grosshirns in zwei Horizontalebenen, u. s. w. (Colored). Tafel V.
39. Photograph after Brokesch. (Page 29).
    Ranke. Der Mensch. 1894.

*In all these plates from Hammerberg the outlines of all the cells have been traced in black ink, since the originals in blue could not be photographed clearly.

40. Querschnitte der drei Keimblätter und die aus ihnen hervorgehenden Bildungen, zu verschiedenen Entwickelungsstadien fortschreitend. Bd. I. S. 138. (Fig. 42).

His. Zur Geschichte des menschlichen Rückenmarkes und der Nervenwurzeln. 1886.

41. Zellen u. Fasergruppe aus einem Spinalganglion von Embryo N. Fig. 4. (Fig. 8.)

42. Durchschnitt durch das Rückenmark von Embryo Br3. Taf. 1. Fig. 46. Zur Geschichte des Gehirns. 1888.

43. Rohr nach Art des embryonalen Gehirnes gebogen. Gehirn von Embryo Lg mit eingetragenen Querzonen. Fig. 12 and 13. (Fig. 43). Address upon the Development of the Brain. Dublin. 1897.

44. Outer surface of the brain tube of a human embryo of four and a half weeks (model.) Fig. 23. (Fig. 44.)

45. Brain of a human embryo of the third month, seen from the outside, with the lateral ventricle opened (model). Fig. 27. (Fig. 45).

46. The three kinds of cells forming the nervous system. Fig. 2. (Fig. 47).

47. Photograph, after Brokesch. (p. 46).

MICROPHOTOGRAPHS OF CEREBRUM CORTEX.

48. Cross section thro convolution, showing thickness of white and gray matter. Human. Hematoxylin. X 100.

49. Showing bodies of about 1000 cells. Human. Hematoxylin. X 100. (Fig. 33.)

50. Four pyramids cells, one with split dendrite. Human. Sublimate. X 100.

51. 16 average pyramid cells, adjacent to former. Human. Sub. X 100.

52. Pyramid with very long apical dendrite. Human. Sub. X 100.

53. 5 pyramids, small, from outer layer. Human. Sub. X 100. (Fig. 25.)

54. 2 " " " " " " " "

55. 22 pyramids with many and long basal dendrites. Human. (Fig. 26.)

56. Section cut slanting to surface; bodies and basal dendrites of 20 pyramids. Human.

57. Section cut parallel to surface; bodies and basal dendrites of 15 pyramids. Human.

58. 2 giant pyramids. Human. (Fig. 27.)

59. 1 giant pyramid. Human. (Fig. 28.)

60. 1 fusiform (lower layer) cell. Human. (Fig. 30.)

61. 4 fusiform cells. Cat.

62. " " " "

63. 1 giant pyramid. Cat. (Fig. 24.)

64. 1 giant pyramid, with long basal dendrite. Cat.

65. 4 average pyramids. Cat. Sub. X 100.

66. " " " Dog. Sub. X 100.

67. 2 " " Rat. Preparation of Dr. Manson.

68. Ammonshorn. Cat.

69. " Rat.

70. Bodies only of over 1000 cells. Hematox. and Picric. Cat. X 50. Preparation of Dr. Lee.
71. Pyramids, capillaries and neuroglia. Cat. Sub. X 100.
72. Capillaries alone. Rat. Silver. X 50. Preparation of Dr. Manson.
73. Caution example in following neuraxon.

CEREBELLUM CORTEX.

74. Cross-section through several convolutions showing thickness of white and gray matter. Human. Hematoxylin. X 10.
75. Cross-section thro one convolution, showing number, size, and position of bodies of Purkinje cells. Hematoxylin. Human. x 44.
76. Cross-section, 2 Purkinje cells. Sublimate. Human. x 100. (Fig. 17.)
77. 2 Purkinjes.
78. 2 Purkinjes with neuraxons.
79. 1 Purkinjes.
80. Lengthsection. 12 Purkinjes from side.
81. " 4 complete Purkinjes from side. (Fig. 19).
82. Purkinjes cut slanting to surface.
83. 1 Purkinje and 4 basket cells.
84. Basket cell with long double-sided dendrites. x 58. (Fig. 21.)
85. Granular cells with bifurcated fibres.
86. Basket cell fibres. Dog. Silver. (Fig. 20.)
87. Single Purkinje. Cat.
88. 3 Purkinjes. Cat.
89. Neuroglia. Human.

SENSORY SYSTEM AND MISCELLANEOUS.

90. Retina. Human. Hematox. and Eocine. X 100. (Fig. 6.)
91. " " " " " X 180.
92. Choclea. Rat. X 100.
93. Spinal ganglia. Foetal pig. X 9. Preparation of Dr. Lee. (Fig. 10.)
94. Skin free nerve endings. Torpedo. X 100. Preparation of Dr. Lee.
95. Nerve endings in muscles. Rattlesnake. X 100. Preparation of Dr. Bratrud. (Fig. 15.)
96. Spinal ganglion. Cat. Silver. X 50. (Fig. 9.)
97. Motor cells in cord. Cat. Cross section. X 100. Fig. 13.)
98. " " " " " Vertical section X 100. (Fig. 14.)
99. " " " " " 7-day child. Cross section. Hematox. X 50.
100. Cells in Pons. Human. X 100.
101. " " " " "
102. " " Copora quadagemina. Human. X 100.
103. " " Thalimus " "
104. " " " Cat. X 100. Preparation of Dr. Manson.
105. Neuroglia in olivary bodies. Human. X 50.
106. Optic chiasma. Horizontal section. Hematox. 7-day child. X 100.

SPINAL CORD AND BULB, ALL HEMATOXYLIN.

107. Cord, Pyramid crossing. Human adult. X 5.
108. " Sensory " " " " X 5.
109. " Pyramid " New born child. X 10.
110. " Sensory " " " " X 10.
111. " Cervical " " " " X 10.
112. " " 7-day child. X 15.
113. " Sensory crossing. 8 months human foetus. X 10.
114. " " " 6 " " " X 10.
115. Bulb. Thro olivaries and XII nerve. Adult. X 2½.
116. Pons, VI and VII nerves. Adult.
117. " " " " " New born child. X 2¾.
118. " " " " " 8 mos. human foetus. X 2¾.
119. " " " " " 7 " " " X 3.
120. " " " " " 6 " " " X 3.
121. " " " " " 5 " " " X 3.
122. Bulb length section, showing sensory tracts. 7-day child. X 2.
123. " " " " post. longt. tracts. X 2.
124. Vertical section thro Thalimus, Corpora mamillaria, pineal gland, etc. Adult.
125. Vertical section thro post. commissure, Thalimus, internal capsule, etc.
126. " " thro striate body, showing the 3 parts and the internal capsule.

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